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Telephone Studies for Beginners

Oftentimes a writer, an editor, or an instructor, errs in taking for granted the fact that his reader or student has a basic knowledge of the subject on which he writes or speaks. Because he himself is full of his subject, he assumes that the fellow for whom he writes or speaks, is equally as familiar with the rules, terms, and laws which form the background for it.

And therein lies the flaw of a great many technical books and articles written today. The expert finds it difficult to discuss his subject from the vantage point of the beginner. Although he may attempt to do this, he usually will find himself soaring far beyond the understanding of the majority of his readers.

There is probably no business today more complicated than the telephone industry. Many achieve positions of prominence with only a mere smattering of a real knowledge of the telephone. Others continue to plod on in the one groove of the business which they have thoroughly learned, scarcely realizing the great opportunities awaiting them, which only require knowledge. In either instance, it is logical to prophesy that they would advance more rapidly if they had a thorough understanding of this industry of which they are a part.

Last month TELEPHONE ENGINEER published the first chapter of a course in Practical Technical Instruction in Engineering and Telephone Management. We hoped it might answer the need of any telephone man who felt a lack of sufficient technical training. We have already received several letters commending us on it. And we have also heard from several telephone men courageous enough to tell us that we had repeated the mistake of other writers and editors—we had aimed too high. We were writing over the heads of some of our subscribers.

And so, with the April issue, we shall start the first of a series of lessons in an Elementary Course in Telephone Practice. For those who are beginners in the industry, or who have been struggling along with insufficient knowledge, this course will be ideal. It starts at the very beginning, taking up electricity, and its application to the telephone. The "ohm" will be defined, as well as the "volt," the "circuit," and various other terms which are used every day by telephone men and of which a complete understanding is essential. It will thoroughly discuss and explain the operation of a switchboard as well as outside telephone instrument operation.

The entire course is clearly and interestingly written, and easy to follow. Even the telephone man who has progressed beyond the elementary stage, may find it advantageous to refresh his memory by reading the series of articles, which will form the complete course. And the beginner in the telephone industry, who will read and study each of the articles carefully and earnestly, will have a background on the complicated subject of the telephone for which he always will be grateful.

Watch for the first study of the Elementary Course in Telephone Practice which will appear in the April issue of TELEPHONE ENGINEER.

And we suggest that beginners, who start their training with the elementary course, save the copies of TELEPHONE ENGINEER beginning with the February issue, so that they can continue with our Engineering and Management Course, after finishing the Elementary Course in Telephone Practice.

Appeal of Plant Schools and Conferences

The day is past and gone forever when any business, especially one with a technical background, can progress without constant recourse to better understanding and improved means of efficiency.

The industrial army must be as constantly and as accurately schooled as are the fighting forces during a war, if a condition which can overcome opposition is to be maintained. Fighting forces are in training every day that they are not engaged

in actual combat. Fighting efficiency has been a large factor in the winning of every war.

Likewise those engaged in telephone industry must keep constantly training to meet the new conditions confronting them from month to month and year to year.

This is true not only of the technical or mechanical side of the business but in regard to operating and financial conditions as well. No business can stand still. If it does not progress, it will regress.

The opportunities for study and training are many for those who are sufficiently alert and farsighted to take advantage of them. In every state or section of the country there are telephone educational possibilities near at hand. Purdue University, Boston Tech, and many other educational institutions with electrical engineering, scientific, and business training courses, hold plant schools and conferences once or twice a year. If not entirely free these are nominally priced. In addition nearly every state has state and district telephone organizations which hold annual schools of instruction lasting from two to four days. At these schools leaders in the various branches of telephony discuss important problems and round table discussions are open to all those present.

It is also well for those constantly eager to learn, to keep in daily touch with business and trade publications, telephone literature, government and state industrial bureau reports, and to watch and engage in conversation with those in other lines of telephone activity about them. No matter how high his position, no man can lose by knowing more about the various phases of his responsibility.

Utilities Meet the Depression

Wherever the financial depression has affected a given locality, the public utilities have suffered along with other business activities in a shrinkage of revenues.

This is especially true in industrial centers where the unemployed have been obliged to curtail telephone expenses, and where the employers, because of a slump in sales, have had a sub-normal use for long distance services.

In the telephone business, such a lapse in patronage is most damaging. Trained workers cannot be reduced since there are still sufficient demands upon the service to require that the telephone plant operate with its accustomed efficiency. Consequently the plant up-keep is as expensive during a lapse of patronage as it is at peak activity.

The public does not understand this, and not only expects regular service on less expense, but sometimes demands that rates be reduced to conform with reduced incomes. That is where the telephone industry is "in the grind."

However discouraging this may be, the old adage still stands that "where there is a will there is a way." The telephone business, under unusual tension because of suspended patronage, must energize every possibility to its fullest. How to do this, is the problem of the hour.

Heretofore we, as an industry, have not given much attention to building patronage, since our efforts have been spent in furnishing adequate facilities for the business which pressed upon us.

However, we must rise to the emergency and meet it with temporary expedients which may stem the tide until conditions become normal once more. Just what resources will be applied to the existing conditions can best be determined locally. The problems of handling telephone depression vary in different localities because of differences in local conditions.

In some states the associations have asked the commissions for suspension or reduction of service connection and moving charges, in order to secure new subscribers who would make up in part for those lost. In other parts of the country individual telephone companies have assumed a conciliatory attitude toward the hard times opposition by asking commissions for such concessions in fees and charges, or rules and regulations, as they deem prudent, in order to stimulate business. Others are increasing advertising and personal solicitation work.

In any event, the telephone industry must carry on. If we cannot grow we must resort to ways and means of preserving that which we have without jeopardizing the future basis of profitable operation. In other words, we may surrender some revenues in this general suspense of business activity for an appearance of fairness, but we should not go so far as to undermine our stable business structure so that it cannot be rebuilt, in more prosperous times.

Our Engineering and Management Course

The Theory and Circuit Arrangement of Magneto Switchboards Is the Subject of This Article, the Second Chapter in a Course of Technical Instruction Prepared for Telephone Engineer by B. C. Burden, Transmission Engineer, Lincoln Telephone and Telegraph Company

General

This article, which is the second of a series dealing with the theory and operation of telephone exchanges, discusses the theory and circuit arrangements of magneto switchboards.

The simplicity of the magneto switchboard would indicate that every telephone man connected with plant maintenance should be perfectly familiar with the circuit features of the various types of magneto boards in use.

In spite of the relatively simple character of magneto switchboards there are many telephone maintenance men who handicap themselves and their efforts by lack of a thorough understanding of the theory and basic differences between different types of magneto cord circuits.

Elements of a Magneto Switchboard

A magneto switchboard circuit should be considered as composed of the following basic elements.

1. The subscriber's line drops and jacks (individual to each line).
2. Cord circuits (common to all subscribers' lines).
3. The operator's telephone circuit (common to all subscribers' lines).
4. Night alarm circuit (common to all subscribers' lines).
5. Generator circuit (common to all subscribers' lines).

These five elements are pointed out in Figure 1, which shows a phantom view of a very popular make of magneto switchboard.

It should be noted that the term "cord circuit" includes not only the cords and plugs, but also the listening and ringing keys, disconnect signals, repeating coils and condensers.

In addition to the five basic elements of a magneto switchboard circuit, Figure 1 designates the correct names for the various parts of such a switchboard.

Description of Operation

The operation of the magneto board shown in Figure 1 is as follows: The subscriber signals the operator by operating the telephone generator so as to send an alternating current out over the line. This sets up a magnetic flux in the core of the line drop which attracts the armature releasing the "drop."

The operator answers by placing one of the answering cords in the jack corresponding to the operated signal, and at the same time she throws the listening key of the same cord forward so as to connect her headset to this cord. Upon obtaining the subscriber's number the operator next places the calling plug of the same cord pair in the line jack of the called number and rings the party by pulling back on the ringing key. Ringing current is obtained either by means of the hand generator which is operated during the period the ringing key is operated, or by means of a power generator.

After ringing the operator restores the ringing and listening key to its non-operated position and the connection is established. When the connected parties have completed their conversation they are supposed to hang up and signal the operator that the cords are to be taken down. The signal is received on the two disconnect signals which are associated with the calling and answering cords.

The night alarm is used to signal the operator when a call is received when the operator is away from the switchboard.

Let us next consider the circuit of each of the five basic elements.

The Subscriber's Line Drop and Jack

Figure 2 shows the basic circuit from drop to subscriber of the typical magneto line drop and jack.

It will be noted that both sides of the drop are disconnected from the line by the insertion of a plug.

Some drops are arranged to remove only one side of the drop winding from the line, as shown in Figure 3. For rural drops it is generally considered satisfactory to disconnect only one side of the drop, but for toll lines it is customary to use drops which disconnect both sides.

It is necessary to disconnect the drop from the line in order to reduce the bridged transmission loss which it would otherwise cause to conversation between lines. This loss would amount to approximately 0.5 to 1.0 db. The transmission impairment effect to conversations on the same line may be considered negligible, as the subscribers are usually located at some distance from the drop, and being close together they are but little effected by a bridged loss at the central office.

All present-day and most of the older type drops are of the "mechanically restoring type." This type of drop is arranged so that the drop shutter is restored to the non-operated position by the insertion of a switchboard plug. Fig-

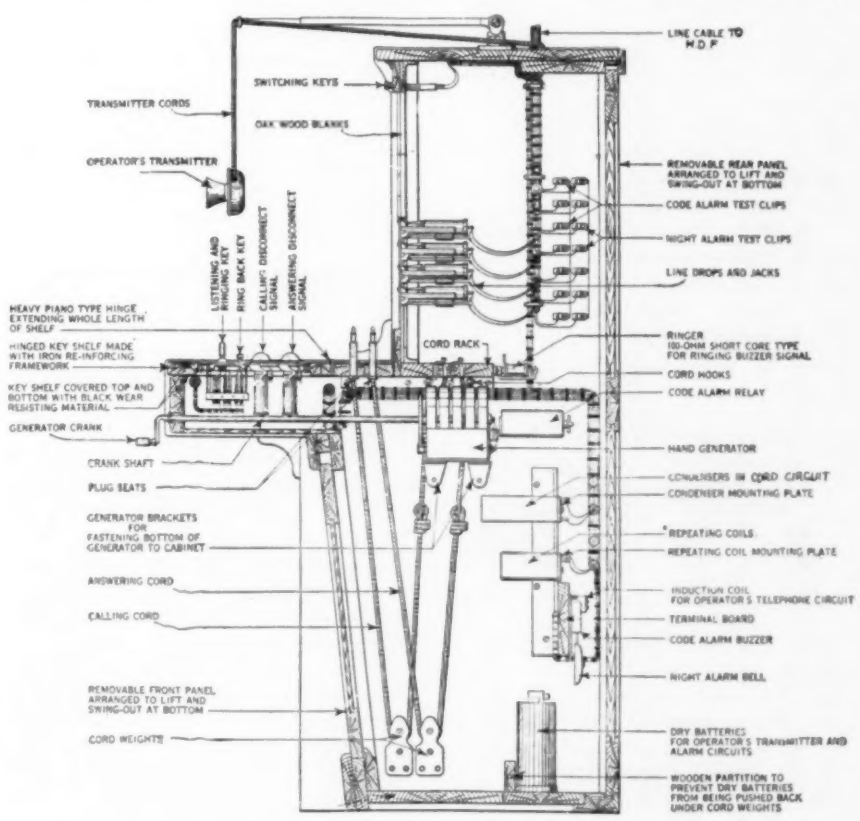

LINE CABLE TO M.D.F.
SWITCHING KEYS
TRANSMITTER CORDS
OAK WOOD BLANKS
OPERATOR'S TRANSMITTER
REMOVABLE REAR PANEL ARRANGED TO LIFT AND SWING-OUT AT BOTTOM
CODE ALARM TEST CLIPS
NIGHT ALARM TEST CLIPS
LINE DROPS AND JACKS
LISTENING AND RINGING KEY
RING BACK KEY
CALLING DISCONNECT SIGNAL
ANSWERING DISCONNECT SIGNAL
HEAVY PIANO TYPE HINGE EXTENDING WHOLE LENGTH OF SHELF
HINGED KEY SHELF MADE WITH IRON RE-INFORCING FRAMEWORK
KEY SHELF COVERED TOP AND BOTTOM WITH BLACK WEAR RESISTING MATERIAL
CORD RACK
RINGER 100-OHM SHORT CORE TYPE FOR RINGING BUZZER SIGNAL
CORD HOOKS
CODE ALARM RELAY
GENERATOR CRANK
HAND GENERATOR
CRANK SHAFT
CONDENSERS IN CORD CIRCUIT
PLUG SEATS
CONDENSER MOUNTING PLATE
GENERATOR BRACKETS FOR FASTENING BOTTOM OF GENERATOR TO CABINET
REPEATING COILS
REPEATING COIL MOUNTING PLATE
ANSWERING CORD
INDUCTION COIL FOR OPERATOR'S TELEPHONE CIRCUIT
CALLING CORD
TERMINAL BOARD
CODE ALARM BUZZER
NIGHT ALARM BELL
REMOVABLE FRONT PANEL ARRANGED TO LIFT AND SWING-OUT AT BOTTOM
CORD WEIGHTS
DRY BATTERIES FOR OPERATOR'S TRANSMITTER AND ALARM CIRCUITS
WOODEN PARTITION TO PREVENT DRY BATTERIES FROM BEING PUSHED BACK UNDER CORD WEIGHTS

Fig. 1—Phantom view of popular make of magneto switchboard

ure 4 illustrates how this is accomplished in one type of drop. The insertion of the plug throws the tip spring up against the restoring spring thus closing the shutter.

Drops and jacks are usually combined as one unit, although on some of the earlier boards separate units were used.

One of the features of drop design that bothered the early designers of telephone equipment was the problem of crosstalk between adjacent drops in the switchboard.

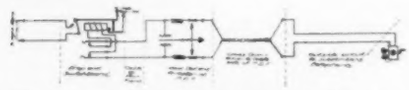


Fig. 2—Basic circuit of magneto line drop and jack

Crosstalking resulted in cases where calls not passing through the switchboard, hence the drops were not disconnected, were taking place on lines having drops located adjacent to each other in the switchboard. This crosstalk was caused by the varying electro-magnetic field surrounding the drop coil inducing current in nearby drops by transformer action.

This crosstalking tendency was eliminated by surrounding the drop coil with a tubular soft iron shell as shown in Figure 5. This iron shell offers a better path for magnetic lines to return to the

Fig. 3—Various line drop arrangement

opposite pole, hence there are few if any magnetic lines in the space outside of the drop.

Drops are generally wound to have a resistance of 500 ohms, although drops used on toll circuits are often wound to 1,000 ohms.

Magneto Board Cord Circuits

A good understanding of the cord circuit is essential to anyone concerned with magneto switchboard maintenance as the major portion of switchboard faults are usually found in the cord circuit.

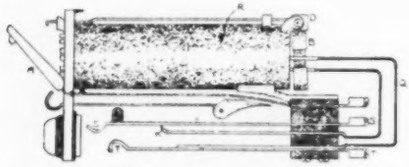


Fig. 4—Typical modern magneto drop

There are three fundamental types of magneto cord circuits, which are:

1. The simple cord circuit.
2. The condenser type cord circuit.
3. The repeating coil cord circuit.

Simple Cord Circuit

The schematic of the simple cord circuit is shown in Figure 6. It will be noted that this circuit connects the tip and ring of calling and answering plugs directly together and has the supervisory drop bridged across tip and ring.

It will be noted that keys are provided which connect the operator's headset across the cord and which permit ringing on either the calling or answering cord.

Such a circuit is ideal from the standpoint of transmission as no equipment which would introduce a loss is connected in series with the line. However, there are several disadvantages which offset this one advantage.

The principal disadvantage being that after a connection is established, ringing on one line, either for the purpose of ringing off or for recalling the operator, will be carried through to the line connected to the same cord circuit, and thus give a false signal.

Another disadvantage of the simple

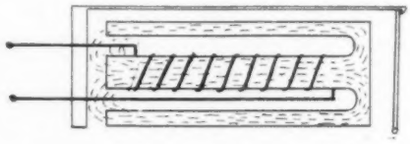


Fig. 5—Tubular iron shell to reduce crosstalk

cord circuit is the fact that it connects the calling and answering subscribers' lines directly together, and as a result an unbalanced line will therefore upset a balanced line, resulting in severe noise or crosstalk under some conditions.

This effect is particularly bad in cases where metallic and grounded lines are connected together.

Because of these disadvantages the simple cord circuit is not recommended.

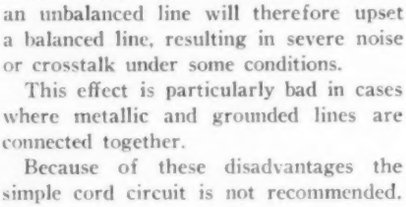


Fig. 6—Simple cord circuit (magneto)

Condenser Type Cord Circuit

The condenser type cord circuit is shown in Figure 7.

This circuit differs from the simple cord circuit described above principally in the method of eliminating the "ring through" disadvantages mentioned. This is accomplished by placing a condenser in series with each side of the tip and ring conductors as shown. The capacity of the two condensers is of such value as to offer a relatively high resistance to low frequency ringing currents, but a much smaller resistance to the higher frequency voice currents.

A ringing current coming in, for example, on the answering cord operates its own supervisory drop, but is too weak after passing through the two series condensers to operate the supervisory drop connected to the calling cord or to ring any of the bells of the line that may be connected to this cord.

It is apparent that the condenser type cord circuit not only prevents false signalling between two connected lines but it also permits the use of separate supervisory drops on the answering and calling cords.

The ringing and listening keys operate in the same manner with the condenser cord circuit as with the simple cord circuit.

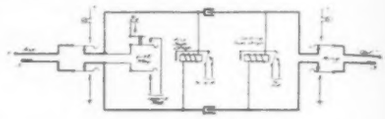


Fig. 7—Condenser type cord circuit (magneto)

The condenser type cord set has the same disadvantage as the simple cord circuit as to permitting an unbalance on one line to effect a connected line which in itself may be balanced.

The transmission loss in the condenser type circuit is somewhat greater than that of the simple circuit, but is not sufficient to materially hamper transmission.

Some boards having cord circuits of this type are furnished with one or two repeating coils which can be used for connecting together balanced and unbalanced lines.

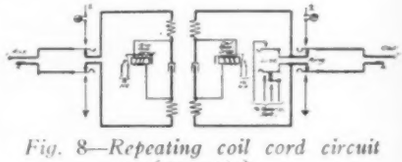


Fig. 8—Repeating coil cord circuit (magneto)

Repeating Coil Cord Circuit

The repeating coil cord circuit is shown in Figure 8. This circuit is the preferred type as it eliminates both supervisory and "ring through" troubles, as well as permits connecting balanced and unbalanced lines together without excessive noise resulting.

The "non-ring through" feature is accomplished by using a repeating coil known as the "talk through non-ring through type." These coils are so designed that they will pass talking currents without severe transmission loss,

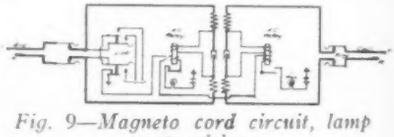


Fig. 9—Magneto cord circuit, lamp supervision

but will not pass low frequency ringing currents.

The condensers connected at the midpoint of each winding of the repeating coil are usually 2 m. f. each. This value capacity offers a low resistance to voice currents, but a much higher resistance to low frequency ringing currents.

As a result of this higher resistance to ringing currents a voltage sufficiently high to operate the supervisory drop is

developed when ringing currents pass through the condenser.

It should be noted that the failure of a supervisory drop to operate properly when the rest of cord functions normal would indicate that the associated condenser was shorted or partially shorted.

The loss in transmission of a good type of repeating coil cord circuit is approximately 1.0 db. (equivalent to loss of 5.3 miles of No. 12 iron metallic circuit).

In this connection it should be pointed out that some of the earlier magneto boards having repeating coil cord circuits used coils which had excessive transmis-

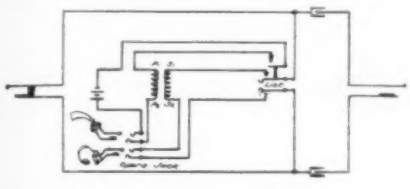


Fig. 10—Operator' telephone circuit (magneto)

sion losses. Managers operating boards that have been in service for a number of years should check up on cord circuit loss, as high loss coils should be replaced by modern coils if standard transmission is to be given.

In some cases, in order to reduce the cost of a switchboard, only one supervisory drop is provided and this is connected to the answering cord on the assumption that the calling party will be

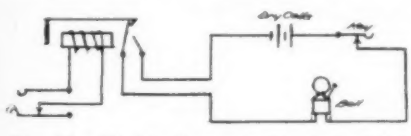


Fig. 11—Night alarm circuit (magneto)

more apt to recall the operator at the conclusion of a call before the cords have been taken down.

Lamp Supervision on Magneto Cord Circuits

In recent years some of the leading telephone equipment manufacturers have developed and introduced to the telephone field magneto boards having cord circuits with lamp supervision.

These boards have proven very efficient and satisfactory in service.

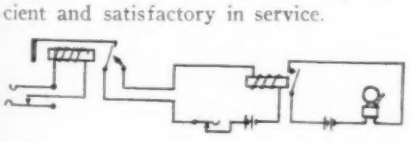


Fig. 12—Night alarm circuit with relay (magneto)

Lamp supervision differs from the supervisory signals previously described in that typical common battery lamps are used and are operated by means of an alternating current relay which locks up passing current through them. Figure 9 illustrates a typical circuit of this type. It will be seen that the alternating current relay is connected across the condenser in the same manner as was the supervisory drop.

In operation, the circuit functions as follows: Generator current from the called or calling party who wishes to recall the operator flows through the windings connected to the associated cord. This sets up a voltage across the series condenser which causes a current to flow in the relay shunted across this condenser. The relay armature pulls up closing a contact which causes a direct current to flow through the second winding on the relay and through the lamp. The armature once attracted locks up and the supervisory lamp will remain lighted until the operator opens her listening key to answer the signal. This removes the ground and causes the armature to fall back and opening the contact, thus putting out the lamp signal.

Battery to operate the lamps and relays is furnished by low capacity storage cells.

The Operator's Telephone Circuit

A typical magneto operator's telephone

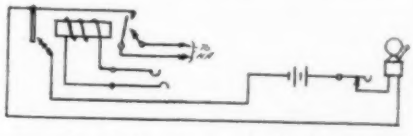


Fig. 13—Code alarm circuit (magneto)

circuit is shown schematically in Figure 10.

The circuit consists essentially of the operator's transmitter, receiver and induction coil, together with a jack to permit disconnecting the headset and breast transmitter from the circuit. The portion of the circuit shown in the dotted square is common to each cord.

Two or three dry cells are generally used for current supply although there are now available small storage battery and charging units such as the Fansteel which insure a uniform current supply and which are recommended for offices

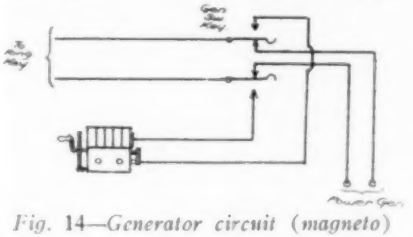


Fig. 14—Generator circuit (magneto)

having considerable traffic or where there is more than one switchboard position.

Provision is usually made for throwing the operator's circuits together on multi-position boards. This permits one operator to use cords in either hers or the adjacent position when only one operator is on duty.

Operators should be cautioned against eavesdropping, as a considerable transmission impairment results from the operator's set being bridged on the line.

Night Alarm Circuit

The common arrangement for the night alarm circuit is shown in Figure 11.

This circuit is very simple and consists merely of a set of contacts at each drop which close a battery circuit through a vibrating type bell which is mounted in the back of the switchboard.

The night alarm will continue to ring until the drop is restored to normal.

In some cases a relay is used to close the bell circuit, as shown in Figure 12. This arrangement is somewhat more reliable than that shown in Figure 11, as the relay will operate on less current than the bell and will therefore be more apt to operate when the night alarm contacts at a jack are not in good condition.

Code Alarm Circuit

A special feature provided on some boards is the "code alarm." This feature operates in a manner similar to the night alarm except that the alarm bell operates only while the armature of the line drop is actuated by the signalling current. It is thus possible to distinguish line calls and central calls when the operator is not at the board. This feature is of special advantage in small residence type exchanges where operating is handled in conjunction with the regular household duties. Figure 13 shows a typical code ringing circuit.

Generator Circuit

Figure 14 shows the usual generator circuit in a magneto board.

In exchanges of more than 50 lines a power generator can usually be used to advantage. The power generators are usually of the type which converts 60 cycle a. c. to 20 cycle a. c. by means of vibrating reeds. Such generators are economical in operating costs and the newer types give very little trouble.

It is customary to operate the power generators in the small office only during the daytime and using the hand generator for what few night calls are received.

Questions on Magneto Switchboards

1. What are the five basic elements in a magneto switchboard circuit?
2. Why is it necessary to disconnect the line drop on calls passing through the switchboard.
3. Why is a tubular iron shell placed over drop coils?
4. What is the basic difference between the three types of magneto cord circuits?
5. What would be the effect on the cord circuit operation if one or both of the condensers in a "condenser type cord circuit" were partially shorted out?
6. What disadvantage does the "condenser type cord circuit" have which the "repeating coil type" does not?
7. What purpose does the condenser in the repeating coil cord circuit serve?
8. How would a shorted or "leaky" condenser affect the operation of a repeating coil cord circuit?
9. Explain the operation of the lamp supervision type of magneto cord circuit.
10. Of what advantage are "code alarms" on magneto boards?

Pointers on Proper Substation Installation

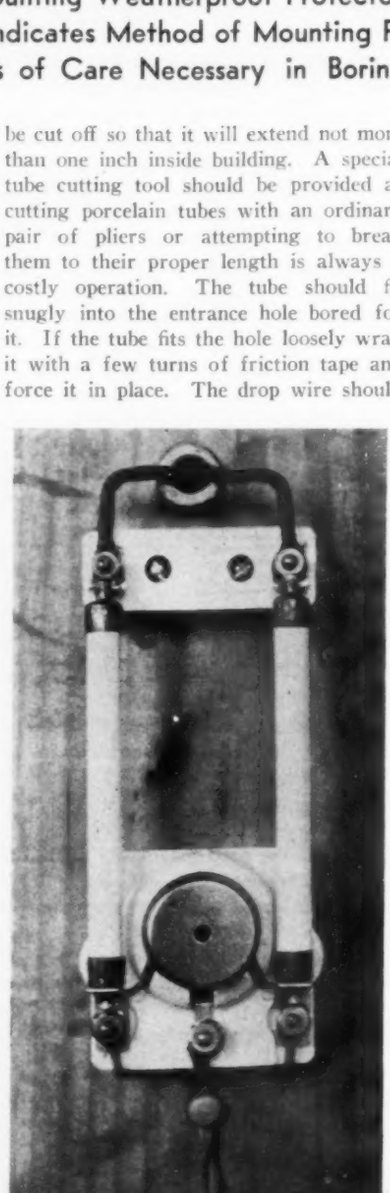
Advantages of Outside Mounting Weatherproof Protector Cited by Ray Blain in This Article in Which He Also Indicates Method of Mounting Protectors; Proper Installation of Ground Wire, and Tells of Care Necessary in Boring Hole for Drop Entrance

After the drop wire has been run from the cable terminal to the building and from here to the point where the house entrance will be made, the next step in the substation installation is the proper placing of the protector and the inside, or house wiring. Extreme care should always be taken by workmen on all inside work as it is this part of the installation which attracts most attention, and neat workmanship will reflect credit on the telephone company. In the old days it was common practice with some companies to install a protector in a living room beside a lace curtain and frighten the subscriber into liking it by telling him that if it was not so placed the house might be burned down by lightning. Requests that wiring be concealed were generally disposed of in like manner, as it was considered too much trouble to fish wire through partitions.

Drop Entrance to Buildings

The drop wire entrance should be located to provide the shortest possible inside wire run from the protector to the telephone. There will, of course, be exceptions to this rule as some installations will require a longer run inside to provide proper drop clearance on the outside of the building. Drilling a hole through a plaster wall is always a difficult operation and should be avoided whenever possible. The best location for entrance holes is generally through window or door frames. If it is impossible to drill the hole through a window or door frame, then drill in the plaster just above it. If the entrance is being made into an unplastered basement, drill the hole a few inches above the foundation, taking care to clear all beams and studdings. When making entrance to a brick, stone or concrete building, drill the hole through window or door frame if at all possible. In some of the modern fireproof buildings these frames may be of heavy iron and in such cases it is generally best to drill holes through the wall. An electrically operated star drill, of the vibrating type, will be found very desirable for this purpose.

The hole for the drop entrance always should be bored sloping slightly upward from the outside as this tends to make it more waterproof. It is advisable to place a porcelain tube in this hole to insulate drop wire from the building. This is especially true if protector is to be placed inside the building. The porcelain tube should always be in one piece and should be cut off so that it will extend not more than one inch inside building. A special tube cutting tool should be provided as cutting porcelain tubes with an ordinary pair of pliers or attempting to break them to their proper length is always a costly operation. The tube should fit snugly into the entrance hole bored for it. If the tube fits the hole loosely wrap it with a few turns of friction tape and force it in place. The drop wire should



This illustration shows a neat protector installation. All ends are neatly formed without spirals or loops of any kind.

be taped slightly at the outer end of the tube and then pulled tightly into it.

Protector Installation

The location of the entrance hole should be at a point which will provide ample space near the inside end of the porcelain tube for the installation of the protector. It can be mounted on either the wall or the ceiling. If mounted on the wall it must be placed in a vertical and never in a horizontal position. If installed in a basement without a plastered ceiling one of the joists makes an ideal protector location. When the protector is to be placed on a plastered wall, it is best to mount a piece of board slightly larger than the protector by placing screws through it into the lath and then mounting the protector on the board. If the protector must be placed on a brick or concrete wall, the board should be fastened with suitable anchors, and on tile walls with toggle bolts. The basement location of a protector is generally desirable if dry, as it is easily reached by the repairman and makes a neat wiring job. Protector locations in attics and bathrooms are always to be avoided. Installations in finished rooms of the modern home are not necessary if a correct wiring plan is used. If a protector must be installed on the wall of any room, the kitchen generally will prove the most desirable. Many prefer that the protector be installed on an asbestos mat, fearing that should a fuse blow there is a possibility of a spark starting a fire. While this is a safety measure, and no doubt a good one, I do not believe that a fire was ever started from this cause. The slots in the fuse should be placed toward the wall by the workman when the protector is being installed. Protector blocks should be removed, cleaned and replaced after the protector is mounted on the wall.

If the drop wire extends for any distance from the entrance to the protector, it should always be insulated well from all woodwork. Split knobs are sometimes used for this purpose and are quite satisfactory. This wiring should never be run near light wires, pipes or conduits of any kind if it can possibly be avoided. I personally prefer that the protector be installed within a few inches of the entrance tube so that any support for the drop wire will not be necessary.

All wires should be attached to the protectors neatly and without spirals or coils of any kind. The wires should also be placed between the two washers provided for that purpose and wrapped around the binding post in the same direction that the nut will tighten.

Recently there has come into general use the outside mounting weatherpoof protector which, to my mind, makes an ideal arrangement. There are several different types of this protector on the market, all of which seem to answer every requirement for adequate protection. There is no doubt but that during

the summer at least the majority of substation troubles can be found in the protectors, and if they are located outside they can be cleared quickly without entering the residence. Many times a troubleman will visit a station only to find that there is no one at home. But if the protector is outside he can clear the trouble at once without a return trip. Outside protectors should be located within reach of a man standing on the ground so that it will not be necessary for the troubleman to carry a ladder.

The outside protector can be mounted in the most convenient location for running both the drop and inside wire. A general practice, and I believe a good one, is to mount the protector just outside of the point on the wall where the telephone is to be located inside. This makes only one hole in the wall necessary and a piece of house wire about a foot long is all that is required. It seems an ideal arrangement from every viewpoint to keep the lightning discharge outside the building entirely. With this equipment it is necessary to drill only one small hole for the entrance of the house wire and a porcelain tube is not required. This design is both a labor and material saver besides being most convenient for the troubleman. The necessity of an outside protector has been known for years, due to the fact that linemen always insist on installing protectors under porches. This practice was generally a failure due to moisture. I believe that the outside protector will increase in favor and use and that within a few years protectors rarely will be mounted inside buildings at all.

The Ground Wire

The ground wire should be run from the protector to the ground connection, either a driven rod or pipe clamp, in the shortest and most direct run possible. It is also good practice to have this wire in one piece without splices. Single rubber-covered No. 14 copper wire is generally considered the most suitable for substation grounds although many use Nos. 16 and 18. The larger wire is stronger mechanically, which is in itself a great advantage. In the old days it was common practice to run the ground wire on the outside of the building without any protection and span the brick foundation, usually a distance of at least two feet from the last wood to the ground. With this method of construction it was not unusual to find broken ground wires, which, of course, defeats the purpose of the protectors. Many times when staples are used to fasten ground wires to board walls they work loose and leave the slack wire whipping in the breeze and it is soon broken. When a ground wire is used only for protection there is no way of testing from the office to determine whether the ground is good or not.

A common practice at the present time when the ground wire is placed on the outside of the building is to encase it in ¼-in. flexible loom, sometimes called woven conduit, or wood moulding. Iron conduit or metal moulding should never be used to protect a ground wire. The loom-covered wire can be fastened to the wood wall with cable clamps and wood screws and to brick walls with the same type clamps and screw or drive anchors. Wires installed and protected in this manner will stay in place and probably never cause trouble. If ground and line wires both pass through the same wall, they should be placed in separate holes at least three inches apart.

In apartment houses or flats it is generally possible to install several protectors in the same location, either in a hall or basement. When this is possible it is an advantage to connect several of them to the same ground wire. Two protectors can be connected to one No. 16 or 18, three to one No. 14, or five to one No. 12 copper wire with absolute safety.

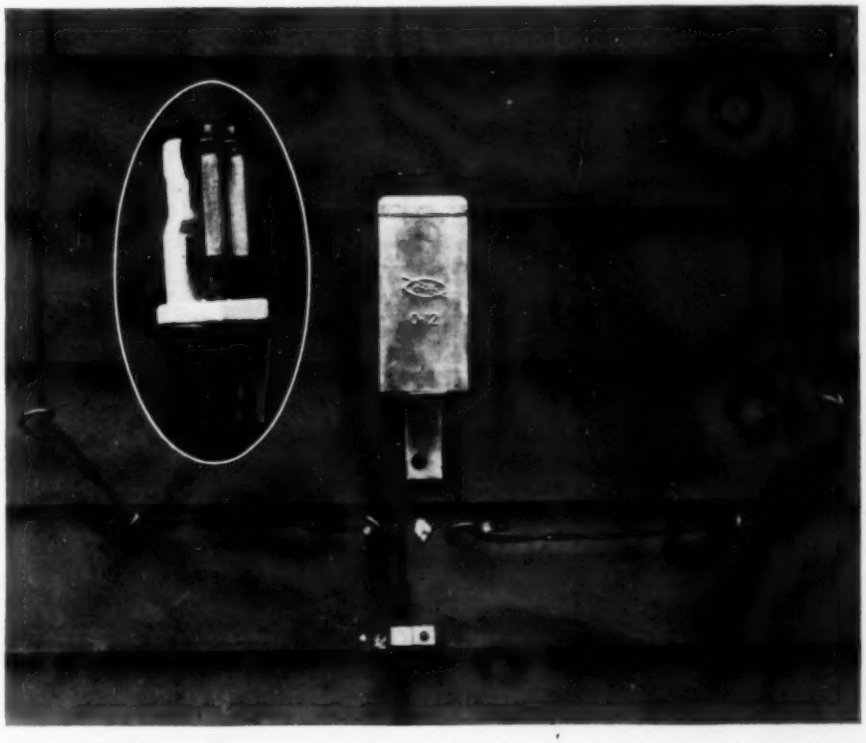
The Ground Connection

The purpose of the protector is to protect the building and the telephone from injury which might be caused from a high potential discharge becoming crossed with electric wires or from lightning discharge. The success of the protector will depend on its ground and this important item of the substation protector installation cannot well be neglected. In some locations a ground clamp on a pipe will be the most convenient while in others the driven rod will prove more desirable. Ground clamps should preferably be placed on cold water pipes, although gas pipes are generally satisfactory if the connection to them is made between the meter and the street. It is always a good practice to install ground clamps on pipes where they will be subjected to the least possible injury, such as close up under sinks or close to walls. It is always best to avoid attachment to pipes which vibrate. Clean pipes thoroughly with sandpaper or emery cloth before installing ground clamps. If pipe is rusty first scrape it with the edge of a file and then clean with sandpaper. Always leave a few inches of slack where ground wire attaches to pipe.

When ground rods are used always drive them vertically and out from the foundation wall 12 to 16 inches. More moisture will generally be found in such locations than closer to walls and there is less danger of hitting obstructions.

Before the ground rod is driven it is a good plan to dig a trench about six inches deep out from the wall and drive the top end of the rod down level with the bottom of it. The joint where the ground wire connects to the piece of bare wire which comes sweat on the top of the ground rod should preferably be placed just above the ground level after the trench is filled. With a rod installation of this type there is very little danger of the connection ever being broken off at the top of the rod and the contact will remain effective over a long period of time without attention.

(*Continued on page* 54.)



Outside weatherproof protector after mounting, showing both drop and inside wires. Insert shows protector before it is encased

Relays Involved in Ringing Key Operations

Common Relays Functioning in Incoming Calls and Their Relation to the Complicated Process in Ringing Key Relays, Here Explained by J. H. Levis, Jr., Telephone Engineer, Rochester, N. Y., in the Ninth of His Series of Articles on Straightforward Trunking

In the eighth installment of this article, published in the February issue of TELEPHONE ENGINEER, there appeared a diagram of the straightforward trunk circuit that involved the relays of the trunk circuit proper and part of the common relay equipment when a trunk is taken by an "A" operator at the distant office. The relays involved were shown in their operated positions. By adding the remainder of the common relays in this operation and the relays involved in the common ringing key operation, the latter will be explained in this installment, as near as possible in the same manner.

There is a more complex situation of relay operations involved in the key operation, such as additional operating relays in the trunk circuit proper and momentary operations in the common equipment, which cause relays to drop out of the trunk circuit proper and common equipment. It will be necessary to describe part of the real relay operation rather than to directly show it in the circuit diagram relay operations.

In tracing the circuit diagram published with this installment reference should be made to the complete circuit diagram in the October, 1930, issue of TELEPHONE ENGINEER. The relays shown in the accompanying diagram have the same relative locations as those shown in the complete circuit diagram.

The circuit diagram accompanying last month's installment, showing all of the relays in the trunk circuit proper that operate at the time an "A" operator at the distant office takes a trunk circuit, remains the same in describing the ringing key operation. The relays that were operated in last month's diagram were Nos. 1, 3, 4, 5, 10. The relays in the commons that operated were 9, 12, 13, 15, 22, 23, 24, 25 and 27. Flash relays A, B, C and D meter. Relays 28 and 29 and relay "X" are operated when the position is occupied by an operator and not by incoming calls. The additional relays in the commons that operate in conjunction with the others just mentioned are relays Nos. 10, 11 and 19.

The No. 10 relay cuts the "B" operator into direct contact with the distant "A" operator. The No. 11 relay brings the common start keys into the trunk circuit proper through the operated No. 5 relay (slow release relay). The No. 19 relay (high resistance) retards the coming in of another trunk call until No. 5 relay in trunk circuit releases. This relay also closes a circuit for the common No. 20 slow release relay. For functions of the common relays refer to December, 1930, and January, 1931, issues of TELEPHONE ENGINEER.

Now that all of the trunk and common relays are operated, the necessary functions to produce a flashing incoming signal to the "B" operator and to cut in the "B" telephone circuit and call passing tone to both the distant operator and "B" operator are had.

The circuit is still further prepared at the same time for the pre-selection of a ringing frequency by means of the operation of the ringing key and proper guard circuits set for the proper entry of another call into the same common equipment previously used.

The incoming trunk lamp continues to flash during the time the "B" operator obtains the station number and party line suffix and does so until a ringing key is operated.

The busy test circuit to the tip of the trunk plug and two jack circuits representing non-busy and a busy line are shown in the accompanying diagram. One of the two jack circuits represents the equivalent of an actual cord circuit sleeve battery circuit with the cut-off relay, which will produce a click in the "B" operator's head telephone when touched, indicating a busy line. The other jack circuit, when touched, will be of the same potential as the test circuit and will not click, indicating a non-busy line.

The operation of the ringing key will be explained in the following paragraphs. The key is of the 16 cycle type and when operated brings the following common relays into action, Nos. 3, 8, 20 and 31.

These relays are not shown operated in the diagram because they are operated momentarily by key operation by the "B" operator, after which they return to a normal non-operated position. It would be difficult to trace the proper operation of the relays which come in and await the key operation as they would show

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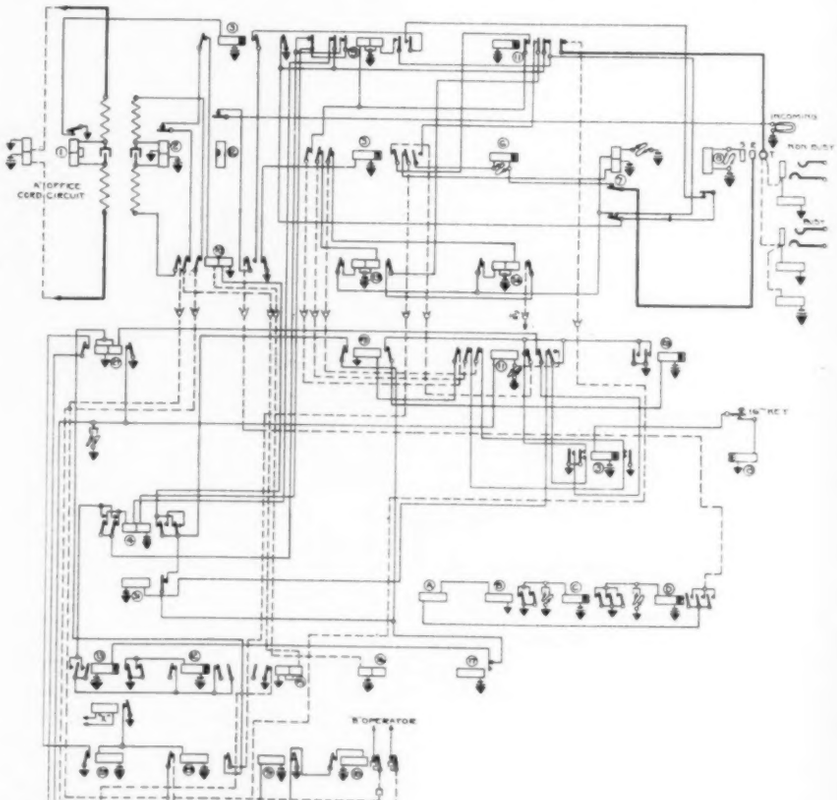


Diagram of straightforward "B" trunk circuit showing incoming call and 16-cycle ringing key wiring and relays

VACUUM TUBE THEORY AND PRACTICE

AS APPLIED TO THE TELEPHONE REPEATERS

General

Long distance telephony would be commercially unfeasible were it not for the telephone repeater.

It is seldom that the average Independent plant man will be involved in repeater maintenance, nevertheless a knowledge of the basic theory and a few facts on the various types of repeaters in use should prove interesting.

This article merely discusses the basic theory of telephone repeaters and describes the principle differences between the several types of repeaters in use.

The study of repeaters is a profession in itself, and the high state of perfection which the present repeaters have reached is due to the tireless efforts of the Bell System engineers.

Had it not been for the invention and development of the repeater by the Bell System, we should probably have neither

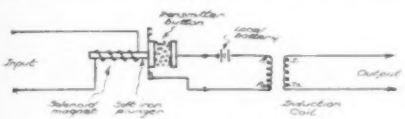


Fig. 1—Schematic of mechanical repeater

worldwide telephone service, nor countrywide radio chain programs, both of which add materially to the convenience and entertainment of our country.

Basic Theory of Telephone Repeater

In connection with the first long distance circuits it was found that on circuits over a few hundred miles long the voice would be weakened to such an extent that it could not be heard at the receiving end. It was realized that the problem could not be solved by increasing the size of the wire, so attention was turned to the development of some device which could be placed at intervals along the line to reinforce and bolster up the weakened voice currents.

The first successful amplifying device to be produced was invented by H. E. Shreeve of the Bell System. This device, which is shown schematically in Figure 1, was first used in 1904, and a large number of these "Shreeve repeaters" were installed and used prior to the adoption of the vacuum tube type repeater.

Referring to Figure 1, it will be noted thta the Shreeve repeater depends for its amplifying actions on the feeble incoming voice currents passing through a magnetizing winding which vibrates an electrode attached to a typical carbon cup similar to that used in ordinary transmitters. Due to the excellent mechanical construction of the Shreeve repeater it was thus possible to reproduce in the output circuit a wave the same as that in the input circuit but somewhat reinforced due to the local battery.

After it was discovered that the vacuum tube made an ideal amplifying element, the Shreeve repeater was displaced by the tube.

The vacuum tube offered more amplification with much less distortion than the mechanical repeater.

Figure 2 shows schematically a simple vacuum tube connected in a telephone line as an amplifier.

At first thought it would seem that a repeater could be devised by merely inserting an ordinary vacuum tube amplifier in a telephone circuit. Unfortunately, this is not possible due to the fact that a vacuum tube amplifier is one-way device whereas a telephone set is two-way. That is, a vacuum tube amplifier will amplify and transmit voice current in one direction only.

The thought may suggest itself that this could be hurdled by using two one-way amplifiers connected as shown in Figure 3. Again we are, unfortunately, not to get by so easy, as this arrangement will not work due to the input of a one-way amplifier being coupled to the output of another, which would result in a continuous oscillation, or a "howl," acting in the same manner as the audio oscillator described on this page in the January number.

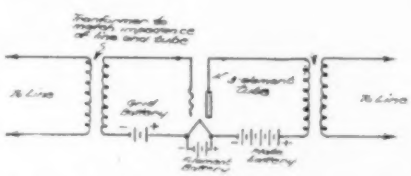


Fig. 2—One-way vacuum tube repeater

All of which brings us down to the bridge or three winding coil, which makes possible two-way amplification without "howling."

Bridge or Three Winding Transformer

In order to get away from the effect just described the three winding transformer as shown in Figure 4 was developed.

The operation of this transformer is as follows: Assume that the voice is being transmitted from east to west. Upon reaching the mid point of the two line windings of the transformer part of the current goes on to the distance terminal while the other part passes into the input or grid circuit of a vacuum tube repeater.

The amplified output of this repeater circulates in the winding 5-6 inducting a

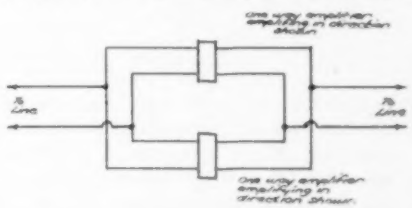


Fig. 3—Two one-way amplifiers connected as shown will not work, due to "howling"

voltage across line winding 3-4. This voltage sets up a current one-half of which flows toward the west station and one-half back to the east or talking station.

If both lines are of approximately the same impedance then there will be no drop of potential across the input to the amplifier, and "howling," or "singing" as it usually is called, cannot take place. If the impedance of the east and west lines is not the same then more current will flow through one-half of the winding than the other, and a difference of potential will be set up across the input to the amplifier and singing will result.

The three winding transformer, while making successful repeater operation on two way telephone circuits possible, greatly complicates the requirements for repeater operation as compared to our first thought that we could insert two one way amplifiers and obtain repeater operation.

The 21 Type Repeater

The arrangement shown in Figure 4 is known as the 21 type repeater.

This is one of the early types of vacuum tube repeaters and has been largely superseded by the 22 and 44 type repeaters. It will be observed that the mid point of the line windings of three winding transformer is connected to the input or grid circuit of the vacuum tube while the output or plate circuit is connected to the extra winding.

As previously explained, if the line in each direction from the repeater has the same impedance, then the amplified voice current passing from the plate circuit back to the line will divide equally, half going back to the talker and the other

half to the listener, and due to the current in the two halves of each line winding being equal and in opposite directions no voltage will be impressed across the grid circuit.

It is obvious that a 21 type repeater would need to be inserted at practically the mid point of a telephone circuit, in order that the impedance on each side of

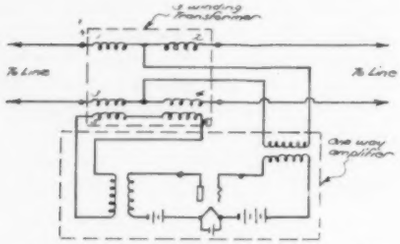


Fig. 4—21 type repeater schematic

the repeater be the same. This, and the fact that half of the amplified energy is returned to the talker, lead to the development by the Bell System of the 22 type repeater which overcame both of the objectionable features inherent to the 21 type.

22 Type Repeater

Figure 5 shows the essential element and circuit arrangement of the 22 type repeater.

It will be noted that the 22 type repeater is merely two 21 type repeaters, and in addition two "balancing networks."

The operation of this type repeater is as follows: Assume the transmission is from east to west. The incoming voice currents arriving at the three winding transformer set up a potential across the grid of the east-west amplifier. The am-

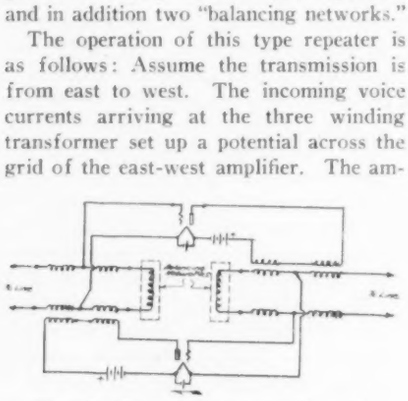


Fig. 5—22 type repeater schematic

plified version of this voice input appears in the plate circuit winding and is impressed across the line winding of the west transformer. The voltage impressed across the line winding causes a current to flow, half of which goes on west to the listening subscriber and half passes into the balancing network and is dissipated.

It can be seen that the balancing network merely serves to balance the impedance of the connected line, so that the current will divide equally in the two halves of the line winding, therefore resulting in zero voltage across the grid input circuit of the west-east amplifier.

The same action takes place in talking from west to east, with the exception that the west-east amplifier functions instead of the east-west.

The 22 type therefore overcomes the objections to the 21 type repeater, and as it will be observed that no energy is transmitted back to the talking subscriber, it therefore is not necessary to place the repeater at the electrical mid point of the line, as the networks can be designed to match any line. These networks should be considered as merely an artificial line (usually merely a condenser and resistance in series).

It is interesting to note that 50 per cent or 3 db. of the incoming energy of the voice current is lost in the balancing network connected to the incoming line, an dthat 50 per cent or 3 db. of the ouput energy is lost in the network connected to the outgoing line. In other words 6 db. is necessarily used up in the balancing transformer arrangement, and this loss plus the desired gain must be supplied by the amplification of the tube.

It would seem that the working out of a method to eliminate the 6 db. loss introduced by the balancing arrangement would offer rich rewards to the successful inventor of such a plan.

There are many thousands of the 22 type repeaters in use today. These repeaters are mounted in relay rack bays and terminated on special test jacks so that they may be tested for satisfactory operation.

They are arranged to operate off of the regular central office battery for filament supply, and utilize a special 120 volt battery for plate supply.

There are several different arrangements of the 22 type repeater, which are known as the: Cord circuit repeater, the terminal repeater, and the through line repeater. The cord circuit repeater arrangement consists in terminating the two ends of a 22 type repeater on a toll cord circuit. A number of the toll lines which require repeaters are arranged so that a connection may be established between any two of these by means of a cord circuit repeater, the gain of which can be regulated by the operator.

This necessitates each toll line having its own balancing network which is connected as soon as the operator plugs in the repeater cord circuit.

Cord circuit repeaters are not popular for various reasons and are being replaced by terminal and through line repeaters to a large extent.

A terminal repeater is merely a repeater placed permanently on the end of a toll circuit, while a through line repeater, as the name implies, is a repeater inserted in a line which does not terminate at the office at which the repeater is located.

There is one other basic type of repeater known as the 44 type (four wire) which was not mentioned in this dissertion, but which will be discussed in a future issue. This particular repeater is used on exceptionally long toll circuits and also as a line amplifier in connection with radio programs transmitted over telephone circuits.

CONVENTION SCHEDULE

Texas Independent Telephone Association, Forth Worth, Texas Hotel, March 24, 25, 26, 1931.

Iowa Independent Telephone Association, Hotel Fort Des Moines, Des Moines, April 7, 8 and 9.

Ohio Independent Telephone Association, Deshler-Wallick Hotel, Columbus, Ohio, April 15, 16 and 17.

Indiana Telephone Association, Indianapolis, May 6 and 7, Claypool Hotel.

Up-State Telephone Association, Rochester, N. Y., May 20, 21, Seneca Hotel.

Pennsylvania State Telephone & Traffic Association, Hotel Penn Harris, Harrisburg, May 26, 27 and 28.

Kansas Telephone Association, Abilene, June 2, 3, 4, The Sunflower Hotel.

REQUIRES MONTH TO INSTALL POPE'S GOLD TELEPHONE

When the telephone system was installed in Vatican City by the International Telephone and Telegraph company, a special instrument was presented to the Pope by the company for his private apartment. The instrument is of pure gold, embossed and engraved in Italy, and it is the first telephone ever to be installed in a Pope's private chambers.

Difficulties encountered in installing the system in Vatican City were relegated by Pilade Leoni, engineer of the International Telephone and Telegraph company, on his return from Italy. Fourteen months were required to complete the installation.

The fact that they were forced to work without plans, among buildings some of which dated back to the eleventh and twelfth centuries, was a serious handicap, according to Leoni.

In the installation of the Pope's telephone, only twenty minutes each day were allowed for this work, from 8 to 8:20 a. m., while Mass was in progress. As a result, this single operation, which ordinarily would have been finished in a day, required one month for completion.

PENDING BILLS INTEREST TELEPHONE PATRONS

Two bills of interest to telephone people have been introduced to the Wisconsin State Legislature. The first provides that telephone poles may be removed from the highways by a town board after a certain time has elapsed from the date the company has failed or refused to give telephone service. And the other provides that co-operative farm organizations may have the right to build and operate telephone lines in competition with existing lines.

Repeating Coils Minimize Noise Currents

Advantages in the Operation of Carrier Telephone Circuits Secured by Interposing a Repeating Coil Between Certain Elements in the Equipment, According to A. G. Ganz, of the Telephone Apparatus Development Department, Bell Telephone Laboratories

In the operation of carrier telephone circuits, a number of advantages are secured by interposing a repeating coil, as a transformer used in this manner is called, between certain elements of the line-terminating equipment. Lack of a metallic connection assists in keeping stray noise-producing voltages, picked up by the line and transmitted longitudinally, from passing through the terminal circuits; the repeating coil also allows less-expensive unbalanced apparatus to be used without disturbing the balance of the line wires to ground.

Noise, due to high-frequency electrical disturbances, is a familiar sound to the radio listener. Telephone lines operated at high frequencies are exposed to the same influences, since they usually include long stretches of open-wire lines which act somewhat as antennas. Currents and potentials induced in the lines are of two kinds. The first, called longitudinal, are those which act in both conductors of a circuit with equal intensity and direction with respect to ground. The second, called metallic circuit currents or potentials, are those acting with equal intensities but in opposite directions through the two conductors of a circuit.

The positions of the two wires of any given telephone circuit are systematically interchanged, or transposed, at short intervals. These transpositions tend to equalize the voltages induced on the two wires, thus minimizing the metallic-circuit induction, but they do not appreciably change the longitudinal circuit voltages and currents, which are therefore propagated along the line to the office at the end of the circuit.

In such an office, the use of a repeating coil is very helpful in minimizing noise at voice as well as at carrier frequencies. This coil consists of two windings with an electrostatic shield between them. The primary winding is connected to the line side of the circuit, the shield to ground, and the secondary winding to the office side. Since the two windings are insulated from each other and from the shield and ground, the repeating coil effects physical separation of the circuits, and introduces a high impedance, due to the insulating material between primary winding and ground, into the path of the longitudinally induced noise currents.

In separating the longitudinally induced noise currents from the talking currents, advantage is taken of the fact that the disturbing currents flow in the same direction with respect to ground and with equal magnitudes in the two wires of the circuit and that the talking currents flow in opposite directions, that is, out one wire and back on the other. The longitudinally induced potentials are prevented from acting upon the office equipment by the presence of the electrostatic shield, which consists of tinfoil sheets separating the primary from the secondary windings.

Paths of longitudinal-circuit noise and talking currents are shown diagrammatically in the following figure. The noise currents, shown by the dotted arrows, flowing down the open wire line equally in the two wires, are prevented by the coil from reaching the office equipment, and pass instead to ground through the capacitance between the primary winding and shield. The primary winding is so arranged that

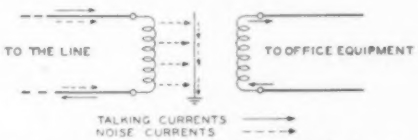


Diagram showing longitudinal-circuit noise and talking currents

the currents from the two wires flow effectively through an equal number of turns in opposite directions before passing to ground through the capacitance to the shield, and since the two currents are equal in magnitude, no flux is set up in the core. The talking currents on the other hand, since they are in opposite directions in the two line wires, flow through substantially all the turns of the primary winding in series, and set up magnetic flux in the core. This flux produces a voltage in the secondary winding, thereby transferring the energy of the talking currents from the line to the office equipment.

Various factors must be considered in the design of such a repeating coil to insure that noise is not produced in the carrier system in other ways. The operation of carrier circuits, for example, is such that if the repeating coil does not present to the line an impedance equal to that of the office equipment, reflection effects are produced, with consequent detriment to transmission, and increased cross talk.

One of the important causes of modification of the office impedance by a repeating coil is the leakage inductance, the effect of which is practically the same as that of an inductance inserted in series with the open-wire line and the office. This leakage exists because the primary and secondary windings do not occupy the same space, and in fact are separated by the shield which permits a certain amount of magnetic flux to leak between the windings.

To compensate for such leakage a method is used which is similar to that employed to compensate for the transmission loss due to capacitance of telephone lines. The latter method, called loading, consists in adding series inductance to compensate for the effect of shunt capacitances. In the repeating coil on the other hand, shunt capacitances are added to compensate for series leakage inductances in an analogous manner. This compensation is obtained within the windings, for the most part, by winding the halves of each winding as two wires in parallel. This increases the capacitance between turns, which is always present to some extent, and this tends to offset the leakage reactance. Since both the capacitance between wires and the leakage reactance vary considerably with different coils, it is necessary, in addition, to connect small adjustable condensers across the terminals of the primary and secondary windings within the transformer case. These are adjusted in manufacture to make as close an impedance match as required. Another example of the various factors which must be taken into consideration in the design of such a repeating coil is the generation of extraneous frequencies due to the non-linear characteristics of magnetic materials. The design precautions taken to reduce such frequency generation include the use of permalloy as core material—on account of its superior magnetic qualities—and the employment of a case of non-magnetic material such as brass to avoid modulation due to leakage flux.

Some idea of the construction of such repeating coils may be obtained from the following description. The magnetic core is toroidal and consists of flat rings of 45 per cent permalloy. These rings are stacked to a height of approximately one inch and held together by a layer of tape over which the primary winding is applied. The shield, consisting of sheets of tinfoil, is lapped completely around the primary winding, and the overlapping portions are insulated to prevent the shield from forming a short-circuited turn. The secondary winding is wound over the shield.

Standard Dimension Tables for Wood Poles

Committee of American Standards Association Recommended Official Adoption of the Ultimate Stresses and Dimensions Discussed in This Article, Which First Appeared in the Wood Preserving News for February

A committee of the American Standards Association has been working on new standard fibre stresses and a new dimension table for wood poles, for some time. This committee was composed of representatives of the American Telephone & Telegraph Co., United States Independent Telephone Association, Western Union Telegraph Co., Postal Telegraph Co., American Institute of Electrical Engineers, American Railway Association, American Electric Railway Association, American Society for Testing Materials, United States Bureau of Standards, United States Forest Products Laboratory, producers of poles of various species, independent experts and others.

After a careful study of the strength of the various species of poles, the committee unanimously recommended the following ultimate stresses be made standard: Southern yellow pine (creosoted), 7,400 lbs. per sq. in.; chestnut, 6,000 lbs. per sq. in.; western red cedar, 5,600 lbs. per sq. in.; northern white cedar, 3,600 lbs. per sq. in.

Under the provisions of the National Electric Safety Code these new values automatically replace the old figures in the safety code. The latter were in general use for a number of years by pole line engineers, but on November 28 the new figures were approved by the Standards Council.

After a careful study of the requirements of the consumers and suppliers, the committee felt it was advisable to develop a standard dimension table based upon equal strengths when new to take the place of the several conflicting class specifications in use by a number of consumers and based upon proper engineering requirements. After a careful study of the requirements the committee adopted the following principles as a working plan for the development of the new tables:

1. All tables shall be based on standard fiber strengths for the respective species. (The values given above were used pending approval by the Standards Council. This approval has been granted under date of November 28.)

2. The tables shall specify dimensions in terms of circumference in inches at six feet from the butt, except for classes of "No Butt Requirements," and circumference in inches at the top for poles of the respective length and classes.

3. All poles of the same length and class shall have when new approximately equal strength or, in more precise terms, equal moments of resistance at the ground line.

4. All poles of different lengths within the same class shall be of suitable size to withstand approximately the same breaking load, assuming that the load is applied two feet from the top and that the break would occur at the ground line.

5. The smallest class for which butt measurements shall be specified shall have a breaking load under the conditions stated in principle 4 of approximately 1,200 lbs.

6. The largest class for which butt measurements shall be specified shall have a breaking load under the conditions stated in principle 4 of approximately 4,500 lbs.

7. The classes from the lowest to the highest shall be arranged in geometric progression, the increments between classes, measured in terms of breaking load, to be approximately 25 per cent.

With the above principles as a general guide, a table of ten classes was prepared. Classes eight, nine and ten, having no butt requirements, were defined by maximum permitted top circumferences only. Classes one to seven, defined primarily by their circumferences at six feet from the butt, were designed to

Proposed Circumference Tables for Creosoted Southern Yellow Pine, Chestnut, Western Red Cedar and Northern White Cedar Poles

CREOSOTED SOUTHERN YELLOW PINE POLES

Class	1	2	3	4	5	6	7	8	9	10
Minimum top circumference—Inches	27	25	23	21	19	17	15	18	15	12

Length of pole (Feet)	Ground line dist. from butt (Feet)	Minimum circumference at 6 feet from butt (Inches)									
16	3½					21.5	19.5	18.0	No Butt Requirement	No Butt Requirement	No Butt Requirement
18	3½			26.5	24.5	22.5	21.0	19.0			
20	4	31.5	29.5	27.5	25.5	23.5	22.0	20.0			
22	4	33.0	31.0	29.0	26.5	24.5	23.0	21.0			
25	5	34.5	32.5	30.0	28.0	26.0	24.0	22.0			
30	5½	37.5	35.0	32.5	30.0	28.0	26.0	24.0			
35	6	40.0	37.5	35.0	32.0	30.0	27.5	25.5			
40	6	42.0	39.5	37.0	34.0	31.5	29.0	27.0			
45	6½	44.0	41.5	38.5	36.0	33.0	30.5	28.5			
50	7	46.0	43.0	40.0	37.5	34.5	32.0	29.5			
55	7½	47.5	44.5	41.5	39.0	36.0	33.5				
60	8	49.5	46.0	43.0	40.0	37.0	34.5				
65	8½	51.0	47.5	44.5	41.5	38.5					
70	9	52.5	49.0	46.0	42.5	39.5					
75	9½	54.0	50.5	47.0	44.0						
80	10	55.0	51.5	48.5	45.0						
85	10½	56.5	53.0	49.5							
90	11	57.5	54.0	50.5							

NORTHERN WHITE CEDAR POLES

Class	1	2	3	4	5	6	7	8	9	10
Minimum top circumference—Inches	27	25	23	21	19	17	15	18	15	12

Length of pole (Feet)	Ground line dist. from butt (Feet)	Minimum circumference at 6 feet from butt (Inches)									
16	3½					26.0	24.0	22.0	No Butt Requirement	No Butt Requirement	No Butt Requirement
18	3½			32.5	30.0	28.0	25.5	23.5			
20	4	39.5	37.0	34.0	31.5	29.0	27.0	25.0			
22	4	41.0	38.5	36.0	33.0	30.5	28.0	26.0			
25	5	43.5	41.0	38.0	35.5	32.5	30.0	28.0			
30	5½	47.5	44.5	41.5	38.5	35.5	33.0	30.5			
35	6	50.5	47.5	44.0	41.0	38.0	35.0	32.5			
40	6	53.5	50.0	46.5	43.5	40.0	37.0				
45	6½	56.0	52.5	49.0	45.5	42.0					
50	7	58.5	55.0	51.5	47.5	44.0					
55	7½	61.0	57.5	53.5	49.5	46.0					
60	8	63.5	59.5	55.5	51.5						

meet the following break loads under conditions imposed in principle 4:

Class 1	4,500
Class 2	3,700
Class 3	3,000
Class 4	2,400
Class 5	1,900
Class 6	1,500
Class 7	1,200

The breaking loads were then translated into terms of moments of resistance at the ground line. The required circumferences at the ground line for the respective species were calculated by means of the formula $Mr = .000264\ f\ C^3$, where Mr is the moment of resistance, f is the standard fiber stress, and C the circumference in inches.

The ground line circumferences thus obtained were converted to circumferences at six feet from the butt by means of average taper values for the respective species. In arriving at the figures for six feet from the butt circumference that appear in the dimension tables the calculated figures were rounded up to the nearest half inch.

The breaking load ratings given above are based on the maximum size pole for any given length and class. The ratings are conservative. Experience over a number of years has shown that the average size pole for a class, based on its six foot from butt circumference, is approximately midway between the minimum circumference permitted for the class and the minimum of the next higher class. In general, therefore, the average pole of a given class will be considerably stronger than the ratings for the class.

The choice of sizes is sufficiently extensive to enable the plant engineer to select poles to meet specific requirements after the load conditions of the line have been determined.

The new dimension tables shown here were taken from the ASA Bulletin of December, 1930. These dimension tables, as well as standard specifications for southern pine, chestnut, western red cedar, and northern white cedar poles, have been approved by the committee but before the final adoption must be submitted to formal vote of the American Standards Association council.

WESTERN RED CEDAR POLES

Class	1	2	3	4	5	6	7	8	9	10
Minimum top circumference—Inches	27	25	23	21	19	17	15	18	15	12

Length of pole (Feet)	Ground line dist. from butt (Feet)	Minimum circumference at 6 feet from butt (Inches)							No Butt Requirement	No Butt Requirement	No Butt Requirement
16	3½					23.0	21.5	19.5			
18	3½			28.5	26.5	24.5	22.5	21.0			
20	4	34.5	32.0	30.0	28.0	25.5	23.5	22.0			
22	4	36.0	33.5	31.5	29.0	27.0	25.0	23.0			
25	5	38.0	35.5	33.0	30.5	28.5	26.0	24.5			
30	5½	41.0	38.5	35.5	33.0	30.5	28.5	26.5			
35	6	43.5	41.0	38.0	35.5	32.5	30.5	28.0			
40	6	46.0	43.5	40.5	37.5	34.5	32.0				
45	6½	48.5	45.5	42.5	39.5	36.5					
50	7	50.5	47.5	44.5	41.0	38.0					
55	7½	52.5	49.5	46.0	42.5	39.5					
60	8	54.5	51.0	47.5	44.0						
65	8½	56.0	52.5	49.0	45.5						
70	9	57.5	54.0	50.5	47.0						
75	9½	59.5	55.5	52.0	48.5						
80	10	61.0	57.0	53.5	49.5						
85	10½	62.5	58.5	54.5							
90	11	63.5	60.0	56.0							

CHESTNUT POLES

Class	1	2	3	4	5	6	7	8	9	10
Minimum top circumference—Inches	27	25	23	21	19	17	15	18	15	12

Length of pole (Feet)	Ground line dist. from butt (Feet)	Minimum circumference at 6 feet from butt (Inches)							No Butt Requirement	No Butt Requirement	No Butt Requirement
16	3½					22.5	21.0	19.5			
18	3½			28.0	26.0	24.0	22.0	20.5			
20	4	33.5	31.5	29.5	27.0	25.0	23.0	21.5			
22	4	35.0	33.0	30.5	28.5	26.5	24.5	22.5			
25	5	37.0	34.5	32.5	30.0	28.0	25.5	24.0			
30	5½	40.0	37.5	35.0	32.5	30.0	28.0	26.0			
35	6	42.5	40.0	37.5	34.5	32.0	30.0	27.5			
40	6	45.0	42.5	39.5	36.5	34.0	31.5	29.5			
45	6½	47.5	44.5	41.5	38.5	36.0	33.0	31.0			
50	7	49.5	46.5	43.5	40.0	37.5	34.5	32.0			
55	7½	51.5	48.5	45.0	42.0	39.0	36.0				
60	8	53.5	50.0	46.5	43.5						
65	8½	55.0	51.5	48.0	45.0						
70	9	56.5	53.0								

EXTEND CABLE SYSTEM

During 1930, more cable for long distance telephone service was placed in the United States by the Long Lines Department of the American Telephone and Telegraph company than in any previous year. This extension of the cable system, putting more and more of the country's long distance lines in aerial or underground storm-proof cable, will directly or indirectly affect practically every section of the country.

One of the important developments of the year was the extension of the New York-Washington-Atlanta cable from Charlotte, N. C., to Greenville, S. C., a distance of about 101 miles.

In the middle west there was much cable development during the year. This work included supplementary cables, the most imoprtant being the additional cables between New York and Chicago.

GOPHERS EAT LEAD CABLE

Employees and officials of the telephone exchange at Wamego, Kans., were puzzled recently when one by one, a number of telephones in a certain district, reported considerable difficulties.

Minute examination and testing of the lines in that vicinity finally revealed the source of the trouble. Gophers had made a meal of part of the lead cable.

Housewives of Wamego were urged to feed hungry gophers in their backyards, in order to keep the telephone service intact.

LAY CABLE UNDER OCEAN NEXT

The day is fast approaching when, in making a telephone call to Europe, the voice will be carried under the water instead of through the air, according to Sergius P. Grace, assistant vice-president of the Bell Telephone Laboratories, Inc., New York.

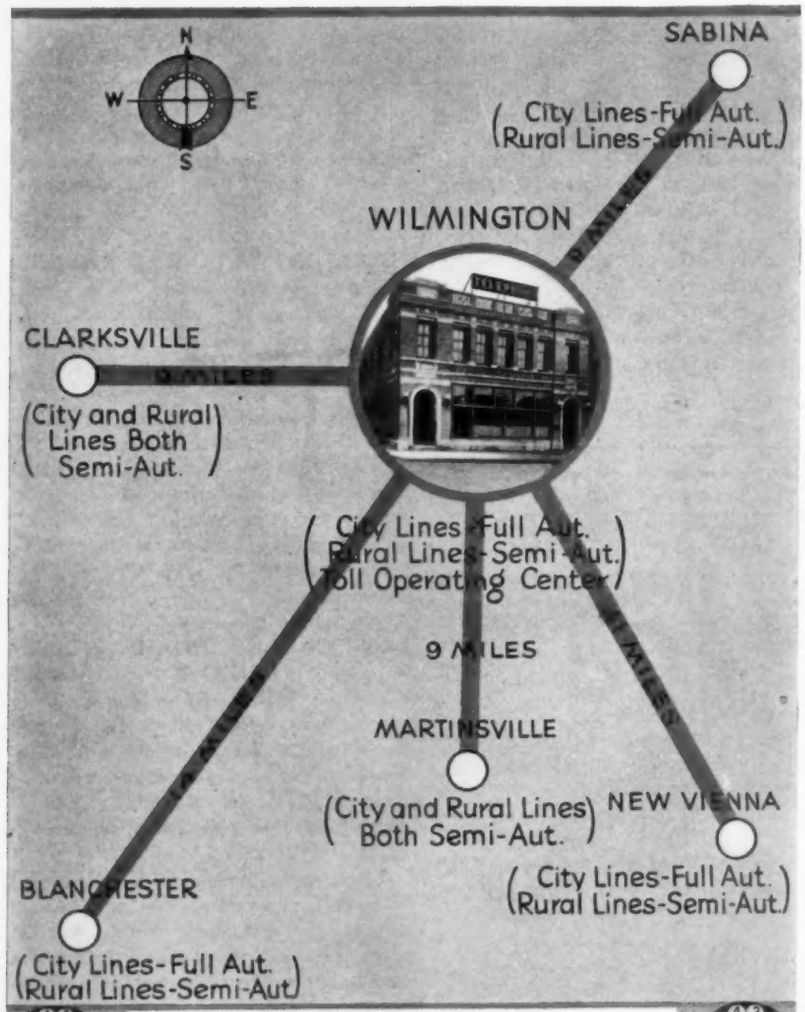
Telephone conversation across oceans today is by wireless. A cable would afford more dependable service, but devices used in long distance land wires cannot be installed or maintained on the bottom of the ocean.

However, Mr. Grace tells of a new insulating material developed by engineers, called paragutta and a new low-loss magnetic material named permivar. Together these new inventions will make telephone conversation feasible under the Atlantic.

An experimental cable under water in the laboratories must give assurance of success before the laying of the real cable is undertaken.

The New York Telephone Co. has purchased a plot of land in the Grand Central zone comprising 37,000 square feet. It is reported that a big improvement is contemplated although no announcement of plans has been made.

Strowger Equipment Never MA$ C



The Wilmington, Ohio, Network, Showing the Method of Operation Used in Each Town, and the Geographical Relationship of the Various Exchanges.

ONE of the features of Strow[g]ipment whic made its application to sm[a]l operation s[o] pletely successful, is its adaptabilit[y] ndard, time- Strowger switches, the most unusual [re]s are readily with the same economy and de[p]which have characterized Strowger operation.

An outstanding example of t[he] of applica typified in the Wilmington, Ohio, n[ew] Clinton Tel Company. This is composed of s[ix] which the Wilmington, serves as the toll center [for] five exchan entirely unattended—full automat[ic] battery, o[r] automatic local battery operation, [a] ination of t being used as indicated in the accom[pa]agram.

Various local factors dictated [the] g plan of t work—which doubly emphasizes the [S]trowger Dial ment never *MAKES* conditions—it [th]em. And it with the finest type of modern, tw[o]r service, a basis such that continued profitabl[e] is assured n for the present, but for the years to [co]ll.

This is one of a series [of] announcements illustrating the application [of] Strowger Dial operation to telephone [net]works.

STROWGER AUTOMATIC DIAL SYSTEMS

GENERAL EXPORT DISTRIBUTORS
The Automatic Electric Company, Ltd., Chicago

In Canada . Independent Sales and Engineering Co., Ltd., Vancou[ver]
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In Japan . . . . . Automatic Telephones Ltd. of Japan, To[kyo]
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Auto

[STROWGER AUTOMAT]
[tory and General O]
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AS Conditions—It MEETS Them

Strow…ipment which have
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Strowger Dial Equipment at Wilmington, Ohio.

Above: Strowger Equipment at Clarksville, Ohio. Below: Plunger Type Line-switches at Wilmington, Ohio. At Left: Exchange Building at Wilmington. The Dial Equipment is on the Second Floor.

Automatic Electric Inc.

Manufacturers of

…GER AUTOMATIC DIAL TELEPHONE AND SIGNALING SYSTEMS

…ry and General Offices: 1033 West Van Buren Street, Chicago, U. S. A.

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American Electric Company, Inc. . . . Chicago
International Automatic Telephone Co., Ltd., London
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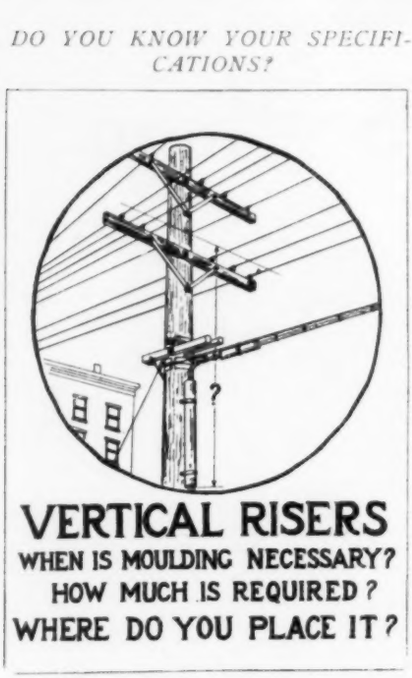
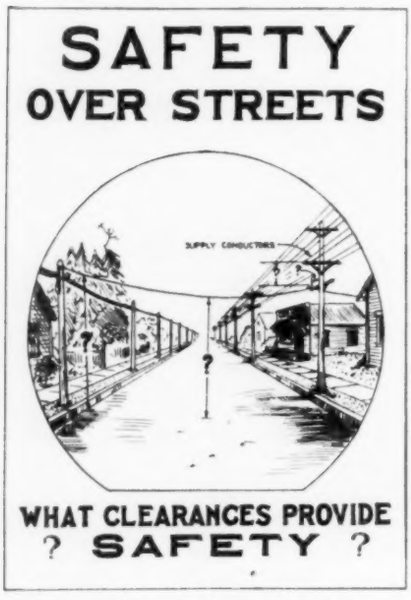
The New Antwerp Telephone and Electrical Works . . . . . Antwerp

LINE AND DESK

HELPFUL HINTS FROM HERE AND THERE

DO YOU KNOW YOUR SPECIFICATIONS?





DO YOU KNOW YOUR SPECIFICATIONS?

Here are this month's problems. Do you find them easy? Readers find that these problems serve to refresh memory as well as to furnish new information. If you run across any interesting problems, write this department about them. Your information may prove valuable to other telephone men. Watch for the answers next month!

(Editor's Note.—These problems are published through courtesy of the California Independent Telephone Association, and answers are provided according to California Railroad Commission orders. There is sometimes a slight variation in telephone rulings of different states, due to differences in population, highways, topography, and climate. Therefore the answers to these problems as published here may not coincide exactly with the answer which would be correct in your state. However, any variation will be slight. The California rulings were chosen as most generally applicable.)

DO YOU KNOW YOUR SPECIFICATIONS?

The answers to last month's problems appearing on page 30 of the February issue are:

No. 1. Clearance Over Private Driveway.

Service drops crossing private driveways shall have a vertical clearance sufficient to clear all vehicles and obstructions, but in no case shall it be less than 10 feet.

No. 2. Climbing Space.

A 30-inch square climbing space shall be maintained on all poles with a few exceptions.

COPPER TO IRON CONNECTIONS MUST BE SOLDERED

In overhauling rural lines, the connections that must be soldered are those between the copper wires leading from the telephones to the line, and ground wires which usually are made of iron.

If dissimilar metals, such as iron and copper, are left unsoldered, a battery action will be set up whenever the connection becomes moist and this will rapidly cause corrosion, which forms a dry powder between the wires.

Copper to iron joints should never be opened for testing without resoldering at that time. However, if it is impossible to solder then, the joint should be protected from moisture by tinfoil and tape until it can be soldered. The best method of soldering such joints is to use a large and extremely hot iron with wire solder and noncorrosive paste, or, if the wires are well sandpapered, rosin core solder can be used.

It is important to leave ample space between the turns of copper on the iron wire so the solder can get in between the turns and become well "sweated" to the iron.

CREOSOTE BURNS

Usually a man approaching a pole feels safe in assuming that it is just another pole. It is not a safe assumption, especially if creosote has been used in preservative treatment of it. Creosote contains carbolic acid, a strong caustic poison. During hot weather the creosote oozes out on the surface of the timber and may produce painful burns. Special care should be exercised to keep it out of the eyes. Recently a lineman, in attempting to straighten a tower brace by striking it with a hand-axe against the creosoted butt of the pole, missed the brace, the blow splashing creosote in his eye. Do not touch the eye or any sensitive surface of the body with fingers that may have creosote on them. "If you have a creosote burn," says the Au Sable News, "flush the place with water. Then apply alcohol or epsom salts, if you have either. One or two borax (sodium borate) tablets in eye-dressing kits may be used if necessary. If the burn is in the eye, wash it with water by means of a dropper, then dissolve a borax tablet in the proper bottle filled with water and flush the eye with the solution, using a dropper. Be careful not to direct the stream on the colored part of the eyeball."—*The Mouthpiece.*

BLOWING FOR THE BLOWTORCH

The blowtorch can be the lineman's best friend or his worst enemy. More than one telephone lineman has alienated friends, family and children simply because constant association with an old and wornout blowtorch left him with an irritable disposition.

While the telephone man has a few more things than the average individual to make his life miserable, nothing is more aggravating to him than a temperamental blowtorch. In spite of this fact there are those who continue to use them for years after they should have been relegated to the junk heap.

Consider the lineman trying to solder out on the line on a windy day. He will take his blowtorch down behind a bank to generate it, rush madly to the line with it as soon as it seems to function properly, and about the time he gets there the torch will go out again and he will have to repeat the procedure.

After several of these rounds with the blowtorch any lineman is justified in losing his temper. The same thing often occurs in sending a blowtorch up a pole on a handline after it has been generated on the ground. It would seem sometimes that the torch takes a fiendish delight in snuffing itself out just before it reaches the top of the pole.

Following several repetitions of this occurrence it is not strange if a lineman bounces the torch down on a rock from the top of the pole. This is a very good remedy for the wornout torch and one which will make certain that the lineman will be supplied with a modern edi-

tion of a blowtorch, after which his troubles will be over. The blowtorch will be the lineman's friend, and his disposition will improve.

The rule which applies to blowtorches is also true of the firepot or furnace used by the cable splicer. If it is antiquated and defective, the splicer's life is one of torment. If it is modern and in working order, it will be looked upon by the splicer as his "best friend."

There is nothing more disastrous from the splicer's point of view than a furnace which fails when the metal is not quite sufficiently hot to wipe the splice, coincident with the onset of a thunder shower.

The time lost on a defective, wornout furnace in six months' time would buy five or six new ones. A splicer really should have two furnaces available so that he can substitute one for the other in case one should fail him.

The new type blowtorches of all makes have many improved features over those of a few years ago. Chiefly, the modern blowtorch will get hot and stay hot in all kinds of weather, and won't snuff out in a high wind. It can be cleaned easily and should a small part wear out, it can be replaced at a small cost. This makes the life of the tool considerably longer than the old style types, which were cheaper to throw away than to repair.

Tests have proved that all torches or furnaces advertised in TELEPHONE ENGINEER are good, and you will not make a mistake in buying any one of them. There is a torch for every need. There are torches of the gasoline type, large and small, which may be secured in the size and shape best suited for your particular work. There are also small automatic alcohol torches which are ideal for certain kinds of work. There should be at least one in every tool kit. They are especially suitable for troubleman, for they are light, small, and suitable for the type of soldering jobs usually performed by the troubleman.

The modern firepot or furnace is easy to generate and will stay hot. Some burn kerosene and others burn gasoline. They are built for strength and will stand hard usage for an extended period. They burn steadily and do not flash up at intervals like the old types which have ignited many a kettle of paraffin and caused serious fires.

The advantages of these new type portable heating appliances are many and should not be ignored by the wide-awake manager who would realize the full efficiency of his outside force, which is impossible with old, obsolete, worn-out and battered torches and furnaces.

TELEPHONE FIRE PROTECTION

By RAY BLAIN

Adequate fire protection for equipment is a matter too generally neglected around the average telephone exchange. It is small wonder that more systems do not burn up than do. This was brought home to me forcibly a short time ago when a fire started in the main cable form of an unused switchboard position in one of our exchanges. Like most fires there seemed to be no reason for it and its origin still remains a mystery.

This exchange was equipped with the usual sand buckets, which are supposed to be so effective in smothering out equipment fires. The wire chief promptly poured sand on the cable form, but even after emptying the contents of two sand buckets the fire smoldered merrily on inside. The difficulty in using sand is that it does not penetrate into small spaces as fire does. The cable form was then torn open and the sand still refused to extinguish the smoldering insulation. When the fire was finally extinguished the cable form, and in fact the cabling in the entire position, was in such a condition that an expensive rebuilding job was necessary.

We took our loss calmly enough but decided to investigate and find out how some of the larger companies were protecting their equipment from the fire hazard and if possible prevent a recurrence of the incident in our own plant. In other words, "after the car was stolen we locked the garage," and were determined to find the most effective means of extinguishing fires in equipment so as to avoid its complete destruction. We soon found that we were several years behind the times with our red sand-buckets.

We decided, as have most large telephone companies, that the inert gas type extinguisher, which is the perfect application of carbon dioxide to the extinguishing of fires, was the most desirable for our requirements. The size chosen weighs 48 pounds and contains 15 pounds of gas which on liberation gives approximately 127 cubic feet of gas. The action of this gas in the extinguishing of a fire is quick as it cuts off the essential elements required for combustion.

The real advantage of the gas is that it is absolutely harmless around the most delicate equipment. There is no danger from moisture or chemical action as the gas is bone-dry, non-corrosive and clean. Neither will this extinguisher deteriorate with age or corrode its container. It is absolutely leak-proof, will not freeze, and does not require periodic refills.

Being a gas, this extinguishing agent penetrates into cracks, crevices and places our sand or any liquid could not reach. It kills the most inaccessible fires in masses of electrical wiring or in and about equipment. This gas is a non-conductor and can be used on live electrical equipment without danger of flash-over or injury to the operator. Its dielectric strength is greater than that of air.

After one of these extinguishers is used it can be easily refilled at any soda-fountain cylinder charging plant or by any dealer of this type extinguisher.

We like this extinguisher and believe it ideal for all-around telephone equipment fire protection. Considering the great expense that can be caused by even the smallest fire in a switchboard if not extinguished promptly, it does not seem that any telephone company can well afford to be without at least one of these extinguishers in each exchange, no matter how small. It is the cheapest form of fire insurance as insurance may pay the money loss of the equipment, but the loss by not being able to furnish uninterrupted service to subscribers cannot be estimated in dollars and cents. This extinguisher will insure continuous service, or at least that it will not be interrupted by fire damage.

ANNOUNCE 1931 BUDGETS

A number of companies in the Bell System have announced their construction program for the ensuing year.

Southwestern Bell Telephone company is to spend $52,000,000 during 1931 for construction in Missouri, Arkansas, Oklahoma, Texas, and Kansas, according to E. D. Nims, president of the company.

Approximately $14,000,000 will be expended by the Chesapeake and Potomac Telephone company of Virginia for plant additions and replacements in the next three year period ending 1933. Of this amount, officials estimate that $3,927,000 will be spent in 1931.

The Chesapeake and Potomac Telephone company has outlined expenditures approximating $11,850,000 for the District of Columbia in the next three year period, of which $3,550,000 will be spent this year.

The company's expansion program provides for a new gain of 26,900 telephones by the end of 1933, with which increase Washington will be served by 195,000 telephones at that time. Telephone development in Washington is one of the highest of any city in the world, there now being one telephone for every three persons.

Extensive improvements are also scheduled for Indiana where President James F. Carroll of the Indiana Bell Telephone company has announced a construction program for 1931 of $5,821,000. This is part of a three year program, expenditures for which are expected to total $18,000,000.

One of the important items in the company's program is $1,850,000 for a new central headquarters building in Indianapolis. The building will have seven stories, built of structural steel and reinforced with concrete and exterior facing of Indiana limestone.

Features of Modern Telephone Pay Station

History of Coin Boxes and Early Difficulties in Establishing Suitable Telephone Rates Explained Here by W. J. Vincent, Development Engineer, Rochester Telephone Corporation, Rochester, N. Y., in Connection with a Detailed Description of Coin in the Slot Telephone Mechanics

For nearly two years following commercial application of the telephone, the service was confined principally to private lines, no satisfactory switching means having been devised up to that time. However, as greater public interest in telephonic communication became evident, telegraph switchboards of the peg type were improvised to enable any two of the former private line subscribers to be connected together. The real value of telephone service was thus enormously enhanced and complexities of the new art not heretofore encountered became manifest and multiplied rapidly, as the number of lines increased.

W. J. Vincent, Development Engineer, Rochester Telephone Corporation

Not the least of the many new problems was the matter of rates. Unlike some of the other phases of the business, the rate question had no counterpart in any of the then known arts and that the groups who set out to determine equitable telephone rates were well nigh overwhelmed was evidenced by one of the members of these early committees when he expressed the view that the inventive genius of Professor Bell in giving us the telephone had been equalled if not excelled by that of the gentlemen upon whom had devolved the duty of making rates.

Tariff, or measured service, not unlike we have today, was proposed as against the flat or unlimited service as early as 1880 and it is interesting to note in this connection that measured service was put into effect in the city of Rochester in the year 1887, continuing until 1889 when the flat rate was restored, no doubt on account of the increased cost of handling calls on this basis by the ticket method, no suitable message registers or meters having yet been developed.

Among the various rates considered was that of the "pay as you go" coin in the slot scheme which became quite popular during the middle nineties, especially in Chicago. This type of service is particularly suitable for public pay stations where it has found its greatest favor, comparatively few of these coin boxes being now used for residence service.

The first coin boxes designed to give the operator control of deposited coins were introduced in St. Louis by the Pan Electric Telephone Company. These coin boxes were of the prepayment type; that is, a coin of the proper size had to be dropped in the slot before it was possible to signal the operator. Apparently this early attempt to inaugurate coin box service did not meet popular approval, for the coin boxes were removed shortly after.

Subsequently Mr. C. E. Scribner of the Western Electric Company developed a prepayment type of coin box in which he utilized the principle of the polarized relay and incorporated other refinements lacking in the earlier types. In the Scribner coin box what is essentially such a relay has its armature so pivoted that it can be tilted one way or the other, depending upon the polarity or direction of the operating current sent out over one side of the line to ground from the central office. An impulse of 110 volts positive current will tilt the armature in the direction that will cause the trap on which the coin rests to likewise tilt, thus allowing the coin to drop into the coin receptacle. An impulse of 110 volts negative current will tilt the trap in the opposite direction and the coin will drop into the coin return in the lower front of the box. In its descent through the chute, each coin strikes a gong and thus gives a distinctive tone or combination of tones for the three sizes of coins used. Slugs or coins not of proper size fall out of the coin chute, before reaching the signal gongs, into the coin return. By forcing the user to deposit a coin in order to get "Central," a great deal of time is saved on each call, for when the called party answers it is not necessary for the operator to request deposit, which usually results in more or less delays due to the user not always having the proper coin handy. On account of this outstanding advantage, the prepayment type of coin box telephones has been adopted for use in practically all of the larger cities, and so in keeping with this policy the Rochester Telephone Corporation approved about a year ago, the placing of all coin box telephones in the city of Rochester on prepayment basis. Before proceeding with the actual modification of our coin box system, however, it was considered advisable to give the matter further study with the view of incorporating automatic collect and return feature, if practicable.

Since by far the largest number of calls from pay stations are for local numbers (nickel calls), it was felt that a substantial operating saving could be effected if such an improvement could be made at a reasonable cost. Furthermore, the timing of pay station calls has always required a good deal of the operators' attention if each call were properly timed, with the result that the cost of attempting to keep even approximately correct records on such calls has been hardly justified. To aid the operator in noting elapse time on her various connections, a pilot lamp arranged to flash a few seconds every five minute interval has been used in some instances, but since this lamp is common to one or more operators and has no direct relation to the starting time of the calls themselves, the actual value of such a reminder is rather small. A simple, automatic means of timing these calls is therefore quite desirable.

Intensive development work was carried on in collaboration with the Stromberg-Carlson Telephone Manufacturing Company for several months, in an endeavor to incorporate these desirable features in the regular prepayment coin box system. Our efforts culminated in the design of a central office cord circuit which it was felt would provide all of the above-mentioned features and a trial installation was accordingly authorized to be made in our Culver exchange. The necessary changes in the coin boxes and station wiring for regular prepayment operation are the same, so that no additional cost in this respect is involved in providing these operating advantages—the actual modifications being confined to the cord circuits and positional equipment. While we have had only a com-

paratively small number of pay stations working on this basis thus far, our traffic people estimate that the improved method of handling these calls shows an increased operating efficiency of over thirty-three per cent as compared with post payment plan. Moreover, on account of greater accuracy of time check with the new system, the average holding time is noticeably reduced, thus reflecting higher efficiency in the use of pay station equipment and other plant facilities.

The operation of the improved system is briefly, as follows: The act of depositing a coin in the proper chute brings in the line signal to the operator regardless of whether the receiver is taken down or not. This is intentionally so arranged that in the event of a "stuck" coin, a failure to collect or return for any reason, such a condition will be immediately indicated to the operator and referred to the trouble desk. The operator answers a call in the regular manner, with a back cord which automatically connects her telephone set to that pair of cords. Assuming that the number desired is Main 246, she then inserts the front or calling cord into the jack of an idle trunk line to the Main Office "B" switchboard. When the two impulses of tone are heard the number is passed to the "B" operator who establishes the final connecting link to the called subscriber's line. As soon as the pay station operator has passed the number she depresses one of the duplicate release keys common to her position, which disconnects her set from that pair of cords and at the same time causes the supervisory lamp signal associated with the calling cord to glow dimly until the called party answers when it is extinguished completely. If the calling party hangs up before the called party answers, the coin will be simultaneously released and drop into the return receptacle. Should the calling party flash the switchhook to attract the operators' attention on account of hearing no ringing tone, or for other reasons, the coin will likewise be returned and the supervisory lamp signal associated with the answering cord will start flashing and continue to do so until the receiver is hung up, or the operator operates the listening key of that connection. If a re-establishment of the same call, or another number is requested, the operator asks for a deposit of the coin, the act of which she is made aware by the distinctive gong tones that reach her ear. Should she be told that the coin has already been redeposited, she can verify this by momentarily withdrawing the plug from the pay station line and observing if the line signal comes in, which it will not do unless the coin is in the chute.

The act of the called party answering sends out an impulse of 110 volts direct current of opposite polarity to that causing the return of the coin so that a collection is made at that instant, which is indicated by the single flash of a green pilot signal at the position. The timing device is also automatically started at that instant and moves over a step every fifteen seconds. If conversation is held five minutes so that the 21st step is reached, a relay in the cord circuit will be locked up under control of the listening key and cause the calling supervisory signal to flash until the operator goes in on the connection to request the deposit of another nickel for further conversation. This condition will be repeated at the end of every five minute period as long as the parties remain on the line.

On calls for which no charge is made, such as police, fire department and the telephone corporation offices, the coin is immediately returned by the operator, there being a return key and collect key provided with each pair of cords. On all calls for "long distance" the initial coin deposited is likewise returned as the collection for entire amount of toll charges is made later by the toll operator over special toll switching trunks.

This system of coin box operation has now been in use in our Culver exchange for several months and its performance has been sufficiently promising to warrant its general adoption for the entire city of Rochester, the project already being well underway.

APPOINTED GENERAL COUNSEL FOR ILLINOIS BELL

Kenneth F. Burgess has been appointed general counsel of the Illinois Bell Telephone Company, effective March 1. Mr. Burgess comes to the telephone company from the Chicago, Burlington and Quincy Railroad, where he has been general solicitor. At the time of assuming his new position, Mr. Burgess also becomes a member of the law firm of Cutting, Moore and Sidley.

Kenneth F. Burgess, General Counsel, Illinois Bell Telephone Company

After his graduation from the University of Wisconsin in 1910 and the law school in 1912, Mr. Burgess practiced law at Lancaster, Wisconsin, and was Circuit Court Commissioner for two years. He has been associated with the legal staff of the Chicago, Burlington and Quincy Railroad Company since 1915, except for the war period. He was appointed general attorney for the company in 1917 and became general solicitor in 1924. From 1918 to 1920 Mr. Burgess was regional commerce counsel for the United States Railroad Administration. He is a member of the Public Utilities Section of the American Bar Association and was chairman of that section in 1930.

Mr. Burgess is a member of the American and Chicago Bar Associations, the American Economic Association, the Academy of Political Science, and the University, Union League, Wisconsin Club of Chicago, Western Railway Club of Chicago and the Glen View and Evanston Country Clubs.

ASSOCIATED TO SERVE MORE THAN HALF MILLION TELEPHONES

Associated Telephone Utilities Co. has acquired control of United Telephone Co., with subsidiaries operating telephone properties in eleven states, according to an announcement by Marshall E. Sampsell, president, Associated Telephone Utilities Co.

For the twelve months ending October 31, 1930, subsidiaries of United Telephone Co. reported consolidated gross earnings of $1,706,730.

The subsidiaries of the United company serve 50,370 stations in 322 communities. In eight of the eleven states served by the United companies, the Associated Telephone Utilities system already has large operating units, facilitating integration of the two systems and making possible large-scale, economical operation of each unit. The states in which consolidations may be effected are New York, Ohio, Pennsylvania, Michigan, Iowa, Missouri, Oklahoma and Texas. In addition the United companies serve in New Jersey, Louisiana and Arkansas.

Among the principal communities served by the United companies are Marion and Bryan, Ohio; Newton, N. J.; Sturgis, Coldwater and Three Rivers, Mich.; Gonzales, Goose Creek, Robstown and Rio Grande, Texas.

With addition of the United companies the Associated Telephone Utilities system will serve more than half a million telephones in over 1,950 communities in 26 states.

Suggesting the use of TOLL S from the home

THE USE of toll and long distance service is widespread in business. But this is not generally true in the home. There is, therefore, a very real need for explaining the speed and simplicity and economy of out-of-town telephone calls.

Women are important and logical prospects for residential toll service. For that reason, advertisements like the two on the opposite page are appearing regularly in a list of the principal women's publications.

In caption, sub-caption and text, these advertisements suggest appropriate occasions for employing toll service . . . when friends move aw to other cities, when children a away at school or college, when th are birthdays, anniversaries, or spe events of any kind. They empha the *complete* and *personal* quality of telephone call . . . its speed and con nience. They stress low cost and qu specific rates for various distances.

Just as long distance advertisi reaches the business man in his of so this advertising reaches and in ences his wife in their home. And telephone companies, whether or connecting, share in the increa traffic that results.

An Advertisement of the American Telephone and Telegraph Company

★

SERVICE

Keep in touch *with out-of-town friends* by telephone

"...and Mildred, we want you and Jim to spend the week-end with us. Can you?... Good! ...We'll expect you Saturday afternoon."

* * *

THERE's no uncertainty when you *telephone!* No "ifs" or "buts." You talk directly to the person you want to reach and get an immediate answer. Your telephone takes you to any one, anywhere, at any time. To friends or stores in other cities—to the folks "back home"—to children away at school or college.

Telephoning out of town costs little. To most places 25 miles away, the station-to-station day rate is about 25 cents; 40 miles away, 35 cents; 75 miles, 50 cents; 125 miles, 75 cents; 150 miles, 80 cents. Where the station-to-station day rate is more than 35 cents, the rates are even lower during the evening and night periods.

From *Christmas to Easter* is a long time at school!

"It's good to hear your voice, Mother! How's Dad? ... Sure, I'm all right again. And my work's going better than ever."

* * *

WITH boys and girls away at school or college, the longest, hardest separation is from Christmas vacation to the Easter holidays. Then a telephone call from home can mean so much to them.

Why not plan to telephone your children regularly while they're away from you? If you prefer, you may have them call you and "reverse" the charges, which will be placed on your monthly bill. It's easy, quick and inexpensive.

For out-of-town calls to places 25 miles away, the day station-to-station rate is about 25 cents; 40 miles away, 35 cents; 75 miles, 50 cents; 125 miles, 75 cents; 150 miles, 80 cents. Where the station-to-station day rate is more than 35 cents, the rates are lower during the evening and night periods. Try it tonight.

THE TECHNICAL CLEARING HOUSE

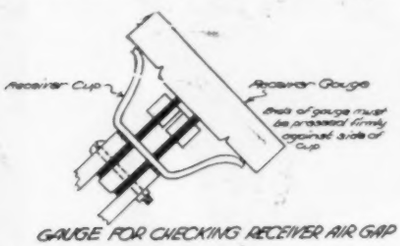
B. C. BURDEN, Editor

Receiver Maintenance

Q.—Will incorrect spacing of the air gap between pole pieces and diaphragm affect receiving efficiency of a telephone receiver?

A.—Incorrect air gap adjustment may materially reduce the receiving efficiency and it is desirable to keep the air gap at its correct value. On regular receivers this air gap should be between 0.014 to 0.016 inch, and for operators' receivers may be slightly less.

Experienced telephone men can gen-



GAUGE FOR CHECKING RECEIVER AIR GAP

Fig. 1

erally determine if the air gap is correct by snapping the diaphragm with the index finger. A better method is to use a receiver gauge, as shown in Figure 1.

Switchboard Cord Repairs

Q.—What is the proper method of rebutting switchboard cords?

A.—Cords should be cut back as follows:

Step No. 1—Cut off the defective or worn portion of the cord and slip outer braid back. Next remove 1½ inches of the inner braid.

Step No. 2—Pull the outer braid forward.

Step No. 3—Apply serving of No. 35 2-ply linen thread as shown to hold braid from slipping back when plug is screwed onto cord.

Step No. 4—Trim off spiral binding strings and cut conductor to proper length to reach terminals in plug.

Step No. 5—Use one of the following methods for attaching conductors to terminal in plug:

Method A—*Wire terminal method:* Slide conductor braid back ¼ inch on tip and ring conductors and thread a No. 28 copper wire through the strands of the tinsel conductors. Leave a loop at one end and wrap the wire tightly around tinsel conductor. Draw threaded end of wire so as to remove loop and twist the two ends together. About one inch of wire should be left for attachment to terminal. The braid on the sleeve conductor should be pushed back and the bare conductor pressed back against the cord and the plug screwed on. The No. 28 wire should next be placed under the terminal screw and the excess cut off. The conductor braid should be slipped down flush with the terminal screw.

Method B—*Soldered tip method:* This method consists in wrapping the tinsel conductors with a fine tinned wire and then soldering to regular cord tips. In some cases tips are pressed on.

Method C—*Punched hole method:* This method consists in merely sliding the braid back on the tip and ring conductors and punching a small hole through the strands near the end. This method is both simple and effective.

The firm whose equipment is used should be consulted for the correct method of rebutting and cutting back and the type of cord determines the method to use.

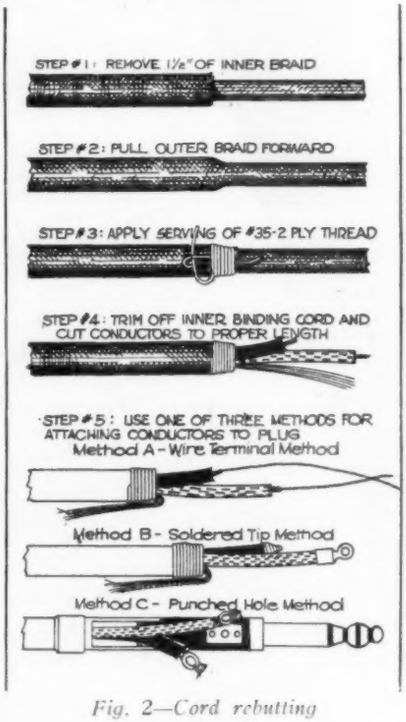
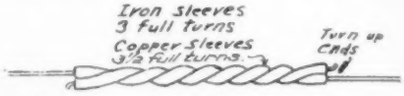

STEP #1: REMOVE 1½" OF INNER BRAID
STEP #2: PULL OUTER BRAID FORWARD
STEP #3: APPLY SERVING OF #35-2 PLY THREAD
STEP #4: TRIM OFF INNER BINDING CORD AND CUT CONDUCTORS TO PROPER LENGTH
STEP #5: USE ONE OF THREE METHODS FOR ATTACHING CONDUCTORS TO PLUG
Method A - Wire Terminal Method
Method B - Soldered Tip Method
Method C - Punched Hole Method

Fig. 2—Cord rebutting

Line Wire Sleeves

Q.—How many turns should be given iron or copper line wire sleeves, and should the ends of the wire be turned up after being passed through the sleeve?

A.—Copper sleeves should be given 3½ full turns and iron sleeves 3 turns. The ends of the line wire should be turned up and cut off as shown in Figure 3.



STANDARD SLEEVE CONNECTION

Fig. 3

Installation of Telephones

Q. What is the standard height for hanging wall telephones when the subscriber doesn't indicate a preference?

A. Wall telephones should be hung so that the transmitter is located approximately 55 inches from the floor.

Transmission Loss of 22 Gauge Cable

Q. How does the transmission loss of 22 ga. telephone cable compare to the loss of No. 12 iron metallic circuit?

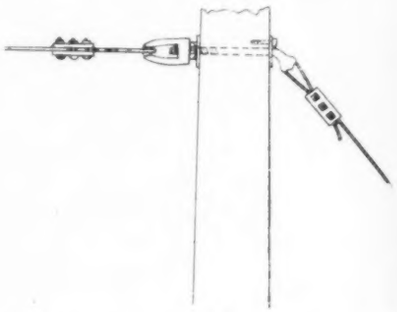


Fig. 4—Eye-bolt method of dead-ending

A. 22 ga. cable has a loss of 1.7 db. per mile, and No. 12 iron a loss of .30 db. In other words one mile of 22 ga. cable would give a loss equivalent to that of 5.6 miles of No. 12 iron.

Eyebolt Method of Dead Ending

Q. Is the eyebolt method of dead ending suspension stand and down guys considered good practice?

A. Yes, the eyebolt method is being used by many of the larger companies and is an approved construction practice.

Figure four shows how both suspension strand and down guys may be fastened to the same eyebolt.

Insulation Resistance of Recovered Condensers

Q. How can recovered condensers or condensers in returned telephones be best tested for insulation resistance, and what requirement should be set up for condensers used in common battery sets and

(*Continued on page* 40.)

A True Gauge of Toll Traffic

THE Calculagraph is not only a vigilant guardian of toll board revenue, but also an accurate gauge of traffic. The toll tickets recorded by the Calculagraph provide a clerical measurement of toll income down to the last cent, and every penny is always accounted for. Managers also find these records a daily index of their traffic flow—convenient, certain, easy to check up in the brevity of the useful information summed up.

The Calculagraph stamps on the toll ticket the beginning of each call together with the time elapsing during each call, down to the quarter of a minute, for any number of calls—producing a permanent and accurate record of each.

Prices and Information on Request.

THE CALCULAGRAPH COMPANY
50 Church Street Dept. 22 New York City

CALCULAGRAPH
THE ELAPSED TIME RECORDER

TELERING

The Super-Ringing Machine

Enjoys World-wide use
Throughout the States, in Canada, Mexico, South America, Europe, and the Orient

FULLY GUARANTEED!

WHY? The answer is obvious.

Let it serve you likewise.

Low first cost
Negligible Operating Expense
No Radio Interference

Operated by Commercial Alternating Current.

Price $44.00 F. O. B. Elyria
It pays for itself.
Sold by Leading Telephone Distributors.

TELKOR, INC., ELYRIA, OHIO
(Write for booklet)

How to tie up service . . . *wholesale!*

. . . It doesn't take much defective telephone cable to tie up a whole system . . . silence the busiest lines . . . win the wholesale ill-will of subscribers . . . To maintain "unbroken service," the watchword of the telephone industry, it pays to use the finest cable obtainable. It more than pays to install Western Electric Lead Covered Cable . . . not the cheapest cable, but the most economical in the long run . . . Why is Western Electric better? The answer is easy . . . Experience since the earliest days . . . largest and best manufacturing facilities . . . selected quality materials . . . careful testing and re-testing . . . and all the tradition for quality implied by the name, Western Electric.

Graybar

OFFICES IN 76 PRINCIPAL CITIES. EXECUTIVE OFFICES: GRAYBAR BLDG., NEW YORK, N. Y.

New Central Office Equipment at Eldon

Kellogg Unit Type Universal Switchboard Installed in Exchange of Iowa-Illinois Telephone Company, Subsidiary of Central West Public Service Company

By O. F. SCHOLLENBERGER
Sales Representative, Kellogg Switchboard & Supply Co., Chicago

A population of 2,200 makes up the town of Eldon, Iowa. This town is situated on the Des Moines river, twelve miles southeast of Ottumwa, in Wapello county. The Wapello county agricultural fairs have been held in Eldon, Iowa, every year for the past thirty-five years. Due to nature's own handiwork, the fair grounds are the most beautiful found in the state. Among other things within the limits of Eldon are three fine banks, large railroad yards that employ hundreds of people, and one of the best high schools of the state, where practically all of the major athletic tournaments are held. Coal mining is the leading industry throughout this territory.

Frank Milhollan, president and general manager of the Central West Public Service Company, Omaha, Nebr., which owns the Iowa-Illinois Telephone Company at Eldon, Iowa

Eldon, Iowa, has been increasing in size and prosperity year after year. Back in 1899 the Home Telephone Co. was organized to render telephone service to the citizens of Eldon. The company, then owned by Mr. J. R. Eddy, at first was serving only twenty-five subscribers, but showed a constant increase in its subscriber list. In 1904 the exchange was sold to the Midwest Development Co. of Cedar Rapids, Iowa.

Incident to the history and growth of the Eldon exchange, it is a fact that the overflowing of the Des Moines river in 1903 entirely submerged the central office equipment, including the Kellogg magneto switchboard, for ninety hours. Since that time, however, the exchange building has been raised to avoid all future flood damage to the equipment.

In 1909 Mr. J. W. Calhoun of Ottumwa, Iowa, purchased this exchange from the Midwest Development Co. The name was then changed to the Eldon Independent Telephone Co.

Nineteen twenty-four showed another decided mark of the progressiveness of Eldon when the city purchased a modern fire alarm system. A control connected to the new fire alarm system was installed in the telephone office.

On April 1, 1928, the Iowa-Illinois Telephone Co., with headquarters at Burlington, bought the Eldon exchange.

In November, 1928, the Iowa-Illinois Telephone Co. became part of the Central West Public Service Co. of Omaha, Neb., and is operated as the Burlington district, serving 24 exchanges in southeastern Iowa and western Illinois. Mr. P. H. Lyday is district manager in charge of this group, with headquarters at Burlington, Iowa.

Frank Milhollan is president of the Central West Public Service Co. which is one of the fastest growing utilities in the Middle West. The general offices of the company are maintained in Omaha, Neb. The Central West Public Service Co. and its subsidiaries supply one or more classes of utility service to 249 communities in North and South Dakota, Minnesota, Nebraska, Iowa and Illinois. Electric light and power are furnished in fifty-five towns; gas in four; water in one, and telephone service in 201.

It became necessary to improve the type of service at Eldon in keeping with the growth of the town. It was decided to install new central office equipment with which they could render common battery as well as magneto service to their subscribers. Consequently the exchange of the Iowa-Illinois Telephone Co. at Eldon recently became the home of a new two-position Kellogg unit type universal switchboard. The new board has an ultimate capacity of 800 universal local lines, wired for 400 and equipped with 300; wired and equipped with ten magneto toll lines; wired for 50 and equipped with 30 magneto rural lines. Each position is wired and equipped with 17 universal cord circuits, arranged for automatic harmonic ringing with revertive tone feature.

Mr. H. H. Peterson became local manager of the Eldon exchange on April 16, 1928. He is an enthusiastic booster of the town and assisted materially in obtaining the new telephone system. Mr. Peterson is well liked by the local subscribers.

F. M. Parsons, general plant superintendent of the Central West Public Service Company, Omaha, Nebr., visited the exchange at Eldon, Iowa, to view the new equipment installed by the Iowa-Illinois Telephone Company.

At the time of the cutover to the new universal switchboard the old magneto board was filled to its capacity of 350 drops, serving 407 subscribers. Thirty-nine new subscribers were added immediately after the installation of the new Kellogg board.

It is interesting to note that many old subscribers still retain their original telephone numbers after a quarter of a century.

A week following the cutover, invitations were issued to the subscribers to attend a formal opening of the new exchange. Approximately 400 men and women inspected the central office equipment. Managers and other employees from nearby exchanges also called to offer their congratulations. Messrs. F. M. Parson, general superintendent of the parent company; R. H. Jensen, district commercial superintendent of the Burlington office, and O. Schollenberger, rep-

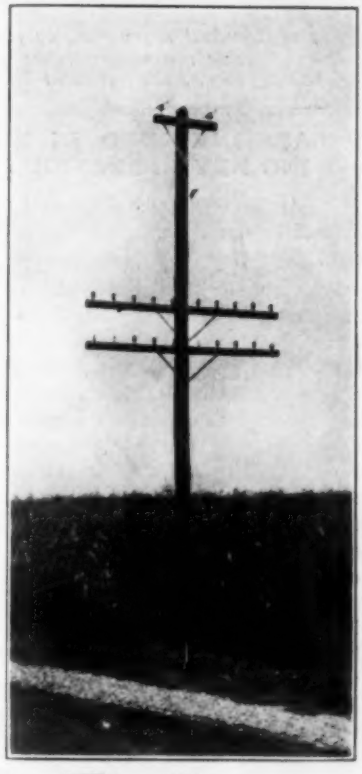
NEW POLE STANDARDS

The question of the proper fiber stress to be used in calculating the strength or load capacity of wood poles has at last been definitely settled, and the following values adopted for the National Safety Code:

Creosoted Southern Pine	7400 lbs.
Chestnut	6000 lbs.
Western Red Cedar	5600 lbs.
Northern White Cedar	3600 lbs.

The American Standards Associated Committee, in conjunction with representatives from the U. S. Forestry Department, Utility Associations, and Pole producers, after an extensive study of many tests and all available data, has solved this problem for the Utility Engineer.

Long and rigid service tests in different sections have already proven the superior durability and resistance of Southern Pine to decay and other destructive agents, when treated, full length, by the pressure method with high grade coal tar creosote oil, and when due consideration is given to the fact that this high breaking strength of Pine is maintained practically uniform, thru this preservation, for more than thirty years, it is readily apparent why Utility Engineers are adopting this type pole as the safest and most economical.



In the work of supplying the pole needs of the Telephone Industry, the Brown Wood Preserving Co. is advantageously situated by reason of its extensive Pine timber holdings, assuring a future supply of poles at uniform cost, and the operation of two modern treating plants, at Brownville, Ala. and Louisville, Ky. This set up enables Brown to furnish Creosoted Dense Southern Pine poles at an economical cost, uniform in quality, and make prompt deliveries.

Try BROWN on your next pole requirement.

BROWN WOOD PRESERVING COMPANY
4th & K Streets, Louisville, Kentucky
Long Distance Telephone—Magnolia 2407

BROWN

CREOSOTED YELLOW PINE PRODUCTS

300,000 Acres One of the largest

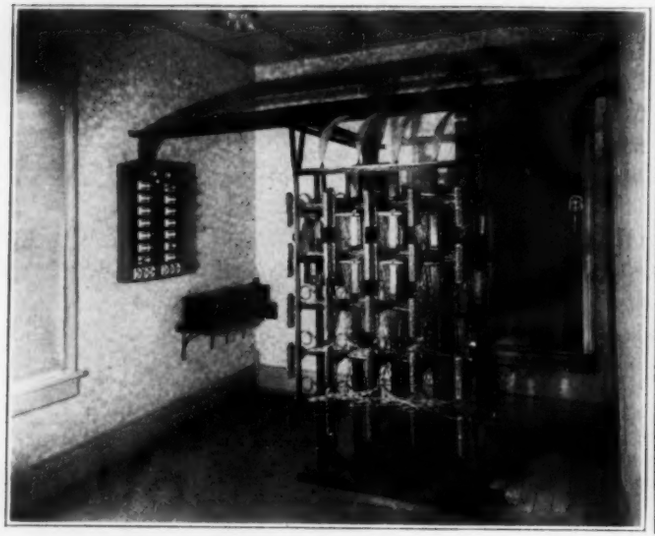
Individual Holdings in America

resentative of the Kellogg Switchboard & Supply Co., were among those present at the opening.

Mr. Lyday writes: ". . . on the night of the cutover not a single case of trouble in the central office equipment or outside plant appeared to mar a perfect 'cut.'"

More than $25,000 has been exended to make the Eldon exchange one of the most modern. Knowing what Kellogg switchboards have accomplished in their other exchanges, the Iowa-Illinois Telephone Co. had no hesitancy in selecting a unit type universal switchboard manufactured by the Kellogg Switchboard & Supply Co. of Chicago as the right kind of a board for Eldon.

The people of Eldon are very proud of their new central office equipment and the type of service they are now getting. They are in accord with the sentiments uttered by the mayor of the city, ". . . we are proud that we can have a system such as you (Iowa-Illinois Telephone Co.) have given us, linking us up with the newest and best of its kind and placing our town on a level with cities of much greater population than ours with common battery telephones."



View of terminal room showing main distributing frame and cable run which serves the new Kellogg switchboard at Eldon, Iowa

Two-position Kellogg Unit Type Universal Switchboard installed by the Iowa-Illinois Telephone Co., at Eldon, Iowa

RELAYS INVOLVED IN RINGING KEY OPERATIONS

(*Continued from page 22.*)

immediate operation, which is not the case.

With the 16 cycle key held operated, a circuit through relay No. 8 to relay No. 3 is closed. Relay No. 8 has no operating function at this time. When relay No. 3 operates, operating ground circuits are established to the main trunk circuit through relay No. 5, via the commons through relay No. 11. This causes the No. 20 slow release relay and the common relay No. 31 to operate. A ground is also placed on the low winding of common relay No. 27, which was operated and which in turn operates relay No. 7 ringing control relay of the trunk, locking up from relay No. 3 on the trunk through its own contacts to relay No. 3. This sets the trunk plug ring circuit to the ringing trip relay No. 6, but open at trunk relays Nos. 5 and 11. The Nos. 13 and 14 trunk relays also operate, making the 16 cycle selection and lock-up from relay No. 7. The No. 9 cut-off relay of the trunk also operates through the non-operated relay No. 11.

It is the operation of relay No. 9 in the trunk that actually starts the complete release of all the common relays that are involved in the handling and disposing of a call and which cause some of the trunk circuit relays, including the flash relays and the trunk circuit relays Nos. 4, 5 and 10 to release. This operation takes the "B" operator from the trunk and restores the trunk lamp to steady brilliancy, indicating that that trunk is ready to plug same into a line jack. The No. 9 relay locks up from No. 3 ground.

When all of the common relays release, another call is allowed to come in in the same method as explained above. As the 16 cycle key has been held operated during all these operations and as another call has come in, the No. 11 common relay will not operate. When the No. 11 relay is released, a circuit is closed from the winding at the connecting point of the non-inductive resistance coil to a back contact of the No. 11 relay and to an operating ground on the No. 3 relay of the common circuit. This absolutely prevents relay No. 11 from operating on the new call at the time relays Nos. 27 and 9 reoperate, but when the 16 cycle key is released the No. 11 relay reoperates as described in the foregoing paragraphs. This is the real preventive for premature preselection.

There are a number of actual circuits existing between relay windings and relay contacts in the future operations of this system that have not been explained, but, as they are added to the circuit in actual sequence of operation or the natural order of handling an incoming call to completion, one should not have much difficulty in tracing them on the diagrams.

THE TECHNICAL CLEARING HOUSE

(*Continued from page 36.*)

those used in magneto sets?

A. Condensers can best be tested by means of a 100,000 ohm D.C. voltmeter and a 100 to 150 volt battery, or if such a meter is not available, any meter which will read up to several megohms will be satisfactory. The condenser to be tested is connected across the test leads to battery and voltmeter and the steady deflection noted. The insulation resistance is then determined by subtracting the deflection in volts from the test battery voltage and dividing this result by the deflection in volts. This quotient multiplied by the voltmeter resistance in ohms will give the insulation resistance in ohms of the condenser. Expressed in equation from this is stated as follows:

$$X = \frac{E - E_v}{E_v} R$$

Where:

X = insulation resistance in ohms.
E = test battery voltage.
E_v = deflection in volts.
R = resistance of voltmeter in ohms.

The city council of St. Paul, Minn., is urging the Ramsey county legislative delegation to support a measure appropriating $190,000 for a state railroad and warehouse commission appraisal of all Minnesota telephone companies.

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NORTHERN or WESTERN

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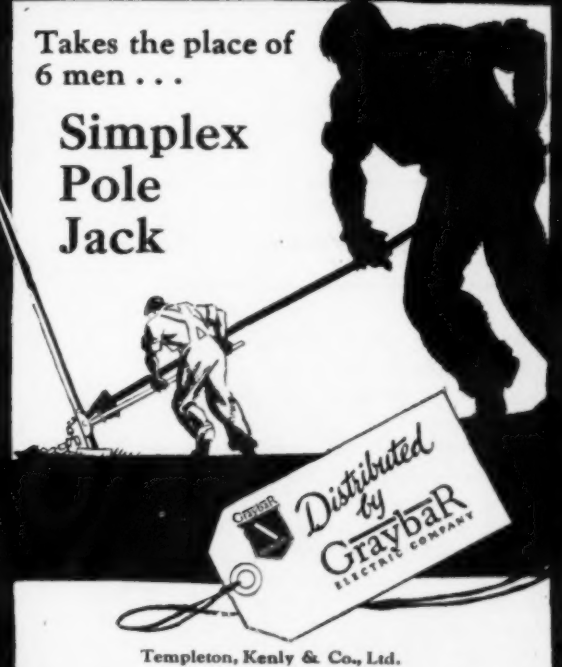
Plain or Treated

B. J. CARNEY & CO.
100 No. Seventh St. Minneapolis, Minn.

Takes the place of 6 men . . .

Simplex Pole Jack



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Foreign Distributors:
International Standard Electric Corporation
Northern Electric Company, Ltd.

Cedar Poles

Northern White Western Red
Plain or Treated Butts

Prompt Shipment from Minneapolis Yard.

T. M. Partridge Lumber Co.
Minneapolis, Minn.

Value of Publications to Telephone Industry

H. C. White, Cable and Equipment Man for the United Telephone Company, Llano, Texas, Here Tells That the Telephone Man Who Would Achieve Success and Fame in His Field Should Study Books and Periodicals Written by Men Who Know.

The painter, the sculptor, or the musician who has become famous did not become so until, in a burning desire to paint the most beautiful picture, carve the most graceful statue, or compose the sweetest music, he surpassed the work of many others.

Forward looking men in the telephone field have as much interest in their work as the artist has in his art. If a lineman, cable splicer, wire chief, or any other employee of the company, wants to be the best one in the world, he can only succeed in this ambition by surpassing the work of others. Not only must each job be well done, but he must learn what lies beyond his present work in order to be prepared for a bigger job in the future.

Many perplexing problems present themselves, and the ambitious man is constantly looking for information that will help him solve them when they come up. There are three ways in which this information may be acquired:

1. By experiment.
2. By asking someone who knows.
3. By reading what men who know have written.

Experimenting is a slow and expensive way of securing information. It is useful in its place, and the man who is observant learns much by it, but a lifetime would be too short for a man to succeed in telephony by personal experiment alone.

Asking the man who knows is a good way to learn but many times when we want to know something the man who knows is not there. Again, when we are told, we might forget some important detail.

Reading what men who know have written is by far the quickest and most accurate way to get information. We can learn in a few minutes things we would never know by experiment. We have printed pages for ready reference after spoken words have passed beyond recall. It is not always the information which we have in our heads that is valuable to us, but that which we have filed away within our arm's reach ready for use when we need it.

Under this heading, we would place the many excellent books now available which cover every branch of telephone theory and practice. In addition to the books, we have the weekly and monthly journals published by and for men in the industry. Writers for these publications are capable men, experts in their line, and their articles are worth many times the cost of subscription. Announcements, by manufacturers, of new and improved equipment appear in these journals as such improvements are made, and if one would be well-informed, these should not be overlooked. Advertisements appearing in these journals also have an educational value. By studying these we can become familiar with new types of equipment before we see them.

Catalogs, bulletins, and data sheets offered by manufacturers to those who need them are a very valuable source of information. The manufacturer of a piece of equipment is constantly studying the performance of his product so that he can improve it if possible. In doing so he learns many things about his equipment that the ordinary user of it does not know. It is then natural that we learn about the various kinds of wire from the men who make wire, poles from men who make poles, anchors from men who make anchors, and so on through the whole list of equipment, both inside and outside.

The plant executive who studies material and equipment can build into his plant the most improved types which are suited to his use. The installer who studies equipment knows its functions and how it should be installed before he gets it. The maintenance man who thus keeps himself posted is always ready for anything new that is put into his plant.

It pays the employe to read and it will pay the employer to encourage reading among his employes.

Book Review

High Voltage Cables, by P. Dunsheath. Price, $3.00.

The question of underground transmission of electric power has become one of increasing importance in recent years and for that reason the developments in the field of design and construction of high voltage cables has been very rapid. It would be difficult in any book to include all of the most recent changes in the art and the author of the book under review expressly disclaims any attempt to do so. He does, however, show the present state of the art and indicates direction in which changes may be expected.

Three chapters are devoted to theoretical considerations relating to dielectric properties, power factor, stress and breakdown. These comprise about one-half of the book. The remaining chapters deal with physical properties and with the construction and current ratings and with joints and terminations. A brief bibliography of the more important papers on each topic is appended to each chapter.

Corso di Telefonia, Part 1. *L'Apparacchio Telefonico.* Ing. Dott. Scipione Treves. Published by Societa Tipografico - Editrice Nazionale, Turin, Italy.

In view of the immense progress in telephone development that has taken place during the past few years, it is only natural that a demand should have arisen among telephone people in Italy for authoritative information on the latest methods and designs in the art. Dr. Treves' "Course in Telephony" meets this demand in a thorough manner.

The book opens with a carefully prepared table of telephone and electrical symbols which seem to follow general European practice, a brief history of telephone development, and a resume of the theory of sound wave transmission.

The following subjects are discussed thoroughly in the "course": transmitters and receivers; miscellaneous telephone instrument parts; descriptions and circuits of the various types of switching apparatus; protective devices; fault location and repairs; and private telephone systems.

It is interesting to note in the chapters on telephones and central office equipment, that a majority of the space is devoted to dial telephone equipment, which reflects the extent to which the dial system is being adopted in Italy. The Strowger system, as supplied by The Automatic Electric Company, Ltd., is covered in a particularly thorough manner, that system having been adopted in a number of Italian cities in the last few years.

CONQUERORS!

SWEEPING everything before them, the old Spanish conquistadores won New World empires with their trusty Toledo blades. Yet, famous as they were, the steel from which Toledo swords were fashioned could not begin to compare in strength and temper with Vacuum Grip Lineman Pliers—those tough precision-built gripping and cutting tools that make every lineman a conqueror in the daily battle against "tough" jobs.

Vacuum Grip Lineman Pliers outwear ordinary lineman pliers three and four to one—and cost little more! Every pair guaranteed to give the user satisfactory service or money refunded.

PURCHASING AGENTS:

Cut down the pliers budget for your company by making Vacuum Grip No. 58's part of your standard equipment. If your men buy their own pliers they will be grateful for the opportunity that No. 58 offers them to SAVE MONEY.

Vacuum Grip Professional Lineman Pliers

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Newport, Pa.

Vacuum Grip
REG. U.S. PAT. OFF.
Pliers

Built *UP* to a Standard—Not *DOWN* to a Price

OVER 700,000 IN USE

WHAT'S one more gale *to Copperweld Insulated Drop Wire!*

Where real staying power is needed—resistance to storms, snow, heat, moisture, high winds—Copperweld more than fills the bill.

This twisted pair insulated drop wire is doubly fortified against *all* that the elements can offer.

Stronger than either copper or steel alone, and quality insulated and weatherproofed to Graybar specifications, no wonder Copperweld stands the gaff.

What's one more gale—to Copperweld!

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THE GRAYBAR TAG—SYMBOL OF DISTRIBUTION

News From the Field

The transmission of speech over a beam of light, by means of an invention called "Bell's photophone" was demonstrated recently by Sergius P. Grace, assistant vice-president of the Bell Telephone Laboratories, Inc., New York, when he caused a flame of light to "speak" at a joint meeting of the Baltimore section of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers at the Maryland Casualty company's auditorium in Baltimore.

A 35 per cent increase in telephone rates has been granted the Illinois Allied Telephone company. Towns affected include Princeton, Spring Valley, Ladd, Bedford, Ohio, Tiskilwa, LaMoille, Manlius, Dover, Sheffield, Wyanet, and Walnut.

Residents of Toledo, Ohio, may obtain a reduction in their present telephone rates and refunds on rates paid since 1925. It has been pointed out that the tentative valuation of more than $104,000,000 set on the Ohio Bell Telephone company properties should enable cities where the rate is under discussion to have a reduction.

Of the approximately 35,500,000 telephones in the world, 32,200,000 may be connected with any subscriber in the Bell System. During 1930 overseas radio telephone service was extended to the point where connections have been established with thirty-one countries including the United States.

The new schedule of charges for service connections, moves, and changes, ordered recently by the Indiana Public Service Commission, reduces the cost of installing residence telephone service from twenty-five cents to $1, depending upon the former charge in the various cities affected by the schedule. In Fort Wayne the charge will be $2 instead of $3; at New Haven and Albion, the charge will be $2.50 instead of $3.50; and at Huntertown, Leo, and Roanoke, the charge will be $1.50 where formerly it was $1.75. Few changes were made in the charges for installing business telephones.

The Northwestern Bell Telephone company plans to put an underground conduit through the city of Fairfield, Ia., for its toll lines.

Franklin J. Mayer, district plant manager in Milwaukee for the Wisconsin Telephone company, has been appointed plant manager for the state. Mr. Mayer entered the telephone business in 1899 with the New York-New Jersey Telephone company.

The building of 7.3 miles of new telephone lines, between New Boston and Joy, Iowa, at an approximate cost of $5,000 has been announced by officials of the Western Illinois Telephone Company. The project calls for the use of 428 poles and 53 miles of wire.

Construction work is expected to be completed within a few weeks on the $50,000 building of the Valley Telephone company at Brownsville, Texas, and the company has announced plans for a building at San Benito, Texas.

The Home Telephone and Telegraph company of Fort Wayne, Ind., has ordered equipment from the American Telephone Company, Inc., of Chicago, which will be added to the Anthony exchange of the company's lines. This equipment is to provide for 100 additional semi-public pay station lines.

The Southern Indiana Consolidated Utilities Corporation has been reorganized with John F. Kent as acting president, and with new boards of directors and executive officers for all subsidiaries. The principal subsidiary of the corporation is the Southern Indiana Telephone and Telegraph company.

The increase of 125,000 telephones in the Bell System in 1930 was the smallest annual gain in this century, according to figures showing additions of stations by the system for the past thirty years. At the present time there are about 20,222,000 stations operated by the Bell System and connecting companies. The increase in 1929 was 899,819 telephones, and the low in recent years until 1930 was the addition of 791,234 telephones in 1927.

Out of every dollar collected by the Bell System company in Tulsa, Okla., 50 cents goes for wages, 2 cents for rent, 11 cents for taxes, 27 cents for material, and 10 cents miscellaneous, according to H. H. Armstrong, division commercial superintendent.

Hamilton A. West, 50, member of a pioneer Texas family and vice-president of the International Creosoting and Construction company, died Friday, February 13, at his home in Galveston, Texas.

Fifteen farmers of the Sugar Lake community, near Grand Rapids, Minn., plan to build a telephone line to serve their farms. They already have cut the poles and conferred with the Bell Telephone company representatives in Grand Rapids arranging to make a connection with the Grand Rapids exchange.

A crew of men working for the Tri-State Telephone company is installing underground cables for the company plant in Windom, Minn. At the completion of the job these cables will provide 18 new terminals, and a capacity for 200 additional subscribers.

Sixty-five new long distance telephone circuits were built in Alabama during 1930 by the Southern Bell Telephone company.

With 12,289 telephones installed in Lima, Ohio, the Lima Telephone & Telegraph company anticipates a substantial increase in volume of business and number of telephone users during 1931.

The Bell Telephone company of Canada will spend a large part of the $20,000,000 expenditures scheduled for 1931 to provide an all-Canada trans-continental telephone hook-up. Trans-continental calls must now be routed over lines in the United States at certain points.

Because of rapid growth in the area served by the Harrison office of the Home Telephone & Telegraph Co., Harrison, Ind., an addition of 500 party lines will be made to the equipment, according to Otto Marahrens, general manager of the company.

The Wisconsin Telephone Co. has completed installation of underground conduit in Stevens Point, Wis., costing approximately $49,000.

The Pacific coast, which now has more than 8,000,000 persons, has close to 2,000,000 telephones, according to the annual financial report of the Pacific Telephone & Telegraph Co., just issued. The company gained 49,776 telephones during 1930. The average number of daily calls in 1930 was 8,688,559, an increase of more than 546,311 per day over 1929.

Telephone companies may tear up sidewalks in front of private property for the purpose of laying cables, without being liable to damages. So ruled Circuit Judge William A. Smith recently in Newark, N. J., in favor of the New Jersey Bell Telephone Co. against which $10,000 damages was asked by the Laurel Garden Corporation in Newark for tearing up the walk in front of its sporting arena.

The Geneseo Cooperative Telephone Co., Geneseo, Ill., is completing plans for the laying of additional cable in the town, according to Robert L. Parker, manager of the company.

PROTECT YOUR CABLE WITH EVERPROTECT

Permits underground installation without conduit. Protects cable against storm damage, corrosion, chemical action, electrolysis and abrasion.

Ask your nearest Jobber for complete details.

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CHICAGO
9TH ANNUAL CONVENTION
Izaak Walton League
(Conserving America's Natural Resources)
WILL BE HELD AT SAME TIME

Telo-Mike «» What It Is and What It Does

New Telephone Device Eliminates All Interference and Brings in the Voice Without Distortion. Avoids Repetition of Conversation and Improves Telephone Service.

A new feature in telephone utility, combining in practical form every ideal of clarity of hearing and confidential talk, has been placed on the market. It will cut out any surrounding irrelevant noises or the user's voice at the will of the person using it. This device resembles a small radio microphone and is called "Telo-Mike."

"Telo-Mike" is simple to use and does not injure the telephone or interfere with regular telephone service in any manner. It becomes a permanent fixture to the telephone, screwing onto the transmitter in place of the regular cone-shaped mouthpiece, using the same screw threads placed there for the mouthpiece. "Telo-Mike" has the same over-all dimensions as the shell of the transmitter container and thus seems to become one with the telephone instrument once it has been attached. It is exceedingly handsome in appearance, giving a modern, up-to-date, business-like tone to the telephone.

"Telo-Mike" was designed to remedy such difficulties often experienced by the average telephone user as carrying on a telephone conversation in the midst of noises caused by clattering typewriters, passing street-cars, riveting in the neighborhood, or crying children; speaking privately over the telephone when others are inconveniently near, and addressing remarks in an aside to those present while using the telephone without being overheard by the other party on the wire.

The "Telo-Mike" is operated by means of a small button. One is placed at the top and one at the bottom of the disc, and either may be used. When one of the buttons is pressed, a slight pressure in turn is exerted on the diaphragm of the transmitter by two small, soft, rubber-tipped plungers, which action nullifies any noises which otherwise would enter the telephone. This greatly simplifies the problem of hearing clearly, and avoids the necessity of "cuddling" the mouthpiece against the cheek in order to prevent the roaring and buzzing in the telephone caused by surrounding noises. Of course, "Telo-Mike" cannot prevent the user from hearing through his other ear, but the noises which are most annoying when using the telephone are those which become exaggerated in the telephone and drown the voice coming over the wire. A light pressure on the button is all that is necessary to be effective, but no matter how hard the user bears down on it he cannot injure the transmitter since the plungers only reach far enough to slightly contact with the diaphragm.

The buttons cannot be pressed when the user himself is talking over the telephone or the transmission of his own voice sound waves will be eliminated as well as other sounds. However, the button may be pressed when the user wishes to turn from his telephone conversation to address a third person present in his office or home, and thus he can speak

This modern appearing telephone is equipped with "Telo-Mike," manufactured and sold by Standard Appliances, Inc., 21 W. Elm St., Chicago, Ill.

freely with no danger of being overheard by the person at the end of the line. When he desires to resume his conversation he merely releases the button, whereupon he can be heard perfectly. Although the user cannot be heard while the button is pressed, there is no interference or disconnection on the line beyond his own transmitter, and he can hear anything spoken into the telephone by the other party on the line.

The purpose of the microphone design is realized when talking into the "Telo-Mike." Noises surrounding the speaker will not confuse his listener because they are diverted from the center of the "Telo-Mike" by the smaller holes surrounding it, and his voice tones, thrust directly on the central area, are reflected with sufficient force to counteract the force of these other sound waves.

Just as "Telo-Mike" is designed to separate the interfering sounds from the voice directed upon it, so it will take a shout and tone it down to a more moderate volume, or take a low voice and deliver it at the other end of the line in a clear tone. Thus by placing his lips within an inch from the "Telo-Mike" and speaking in exceedingly low tones, a person can converse over the telephone with no fear of eavesdropping by those near him, yet confident that his message will be clearly delivered to the party at the other end of the line.

Although the "Telo-Mike" was invented two years ago, it has only been placed on the market within the last few months. Previously it was submitted to a number of exhaustive tests to prove its durability and adaptability. The most important test was that of the mechanical electrical testing machine developed specifically for the purpose of testing the durability, mechanical perfection and the life of the "Telo-Mike" on an average or constant usage, and the effect that either a constant or an average use of the "Telo-Mike" over a period of years would have on the telephone transmitter to which it is attached.

A "Telo-Mike" was installed on the telephone transmitter at the start of the test and the test was continued with the same "Telo-Mike." At time of going to press the "Telo-Mike" and transmitter both were functioning perfectly after more than 100,000 depressions of the "Telo-Mike's" rubber-tipped plungers against the diaphragm of the standard Western Electric transmitter used in connection with the test.

Before starting the test the milliamperes reading was taken, which was standard. The testing machine, which is motor driven, was hooked up with the telephone transmitter and receiver, induction coil, dry batteries and milliampere meter, with the motor connected by belt to a device on which was attached a cyclometer with a cam revolving on a projecting shaft, making firm depressions against one of the "Telo-Mike" buttons at the rate of forty-four per minute, thoroughly shutting out from the telephone receiver the sound of the motor on each depression.

At the time when 100,000 depressions had been made against the diaphragm the milliampere meter showed the same reading as it did at the time the test was started. This proved definitely that "Telo-Mike" does not in any manner harm the diaphragm of the transmitter.

"Telo-Mike" is manufactured in four types in order to fit the different tele-

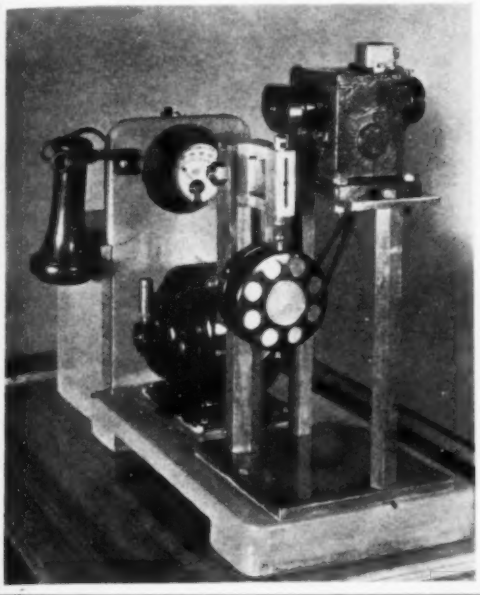
(*Continued on page* 53.)

Exhaustive Tests Prove "TELO-MIKES" *Durability* and *Adaptability*

BELOW you will find reproduced a photograph of our Mechanical Electrical Testing Machine, developed specifically for the purpose of not only testing out the Durability, Mechanical Perfection, and the Life of "Telo-Mike" on average or constant usage, but also the effect, if any, that even a constant or an average use of "Telo-Mike" over a period of years would have on the telephone transmitter to which it was attached.

The Telephone Transmitter and Receiver hooked up in connection with the testing machine is standard equipment. The "Telo-Mike" shown in the illustration was installed on the telephone transmitter at the start of the test, and the test was continued with the same "Telo-Mike". After more than 100,000 depressions of the plungers against the diaphragm of the transmitter, the "Telo-Mike" is still functioning perfectly, as is also the telephone transmitter.

Before starting the test we took the milliamperes reading which was standard. After more than 100,000 depressions the reading is the same as was recorded at the start of the test.



"TELO-MIKE" is a totally new departure in telephone utility, combining in practical form clarity of hearing, confidential talk and a modern, 20th century appearance. It clarifies reception through the elimination of interference and surrounding noises, bringing in the voice without distortion, avoids repetition of conversation and improves telephone efficiency. A low voice is delivered at the other end of the line in a clear, understandable tone. Private conversation can be carried on over the wire in the midst of a crowded room without being overheard. Side conversation while using the telephone cannot be heard by the party on the other end of the line. Every care has been exercised to include the very best of parts and workmanship.

"Telo-Mikes" are distributed by independent salesmen or by salesmen working in conjunction with their local telephone company on a percentage basis. We invite correspondence from telephone companies relative to the marketing of "Telo-Mike". This advertisement, mailed to us together with One Dollar and the make of equipment used, by any telephone official or employee, will bring in return one standard black "Telo-Mike".

"Telo-Mikes" are manufactured with proper threads to fit all standard desk or wall telephones. No models are provided for the "French type" of telephone.

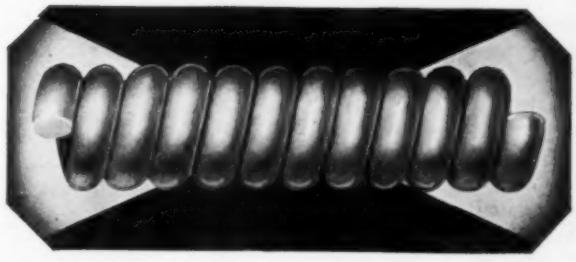
STANDARD APPLIANCES, INC.
Telo-Mike Division
21 W. Elm Street
CHICAGO, ILLINOIS U. S. A.

The Service-Hour Cost is *Less*

YOU BUY telephone batteries for just one purpose—to give satisfactory service for a long time. Short service means high cost—long service, low cost. Ray-O-Vac Telephone Batteries cost less because they deliver more service—many hours more than other cells. This is proved not only by competitive tests conducted in accordance with U. S. Government standards, but by users' records as well. Moreover, there's an appreciable saving in service costs. Standardize on the Ray-O-Vac Telephone Battery—the cell with the low service-hour cost.

FRENCH BATTERY COMPANY
Madison, Wisconsin
General Sales Offices:
20 North Wacker Drive, Chicago, Illinois
Makers also of Flashlight Batteries, Rotomatic and Standard Flashlights and Electric Lanterns

RAY-O-VAC



Galvanized Telephone Wire and Steel Strand

Crapo Galvanized Wire can be wrapped around its own diameter without injury to its pure zinc coating....That is one of a number of reasons why **Crapo** Galvanized Telephone Wire and Strand can be depended upon to reduce maintenance cost.

Look for the **Crapo** Seal!

Indiana Steel & Wire Co.
Muncie, Indiana

INDIANA STEEL & WIRE CO. Crapo Galvanized MUNCIE IND

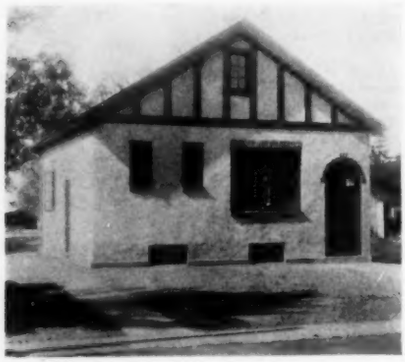
Crapo GALVANIZED PRODUCTS

Restores Service in Record Time

Rochester (N. Y.) Telephone Corporation Complimented for Excellent Emergency Job in Livonia, New York, After $175,000 Fire Had Destroyed Telephone Building and Equipment.

E. A. Reinke, Commercial Sales Manager,
Stromberg-Carlson Telephone Mfg. Co.

Although a $175,000 fire, in which the telephone building and equipment were completely destroyed, was raging in Livonia, New York, on March 19, 1930, the Rochester (New York) Telephone Corporation could not be stopped from



New telephone building erected at Livonia, N. Y., by the Rochester, N. Y., Telephone Corporation

restoring service to that community within twenty-four hours after the fire had been subdued.

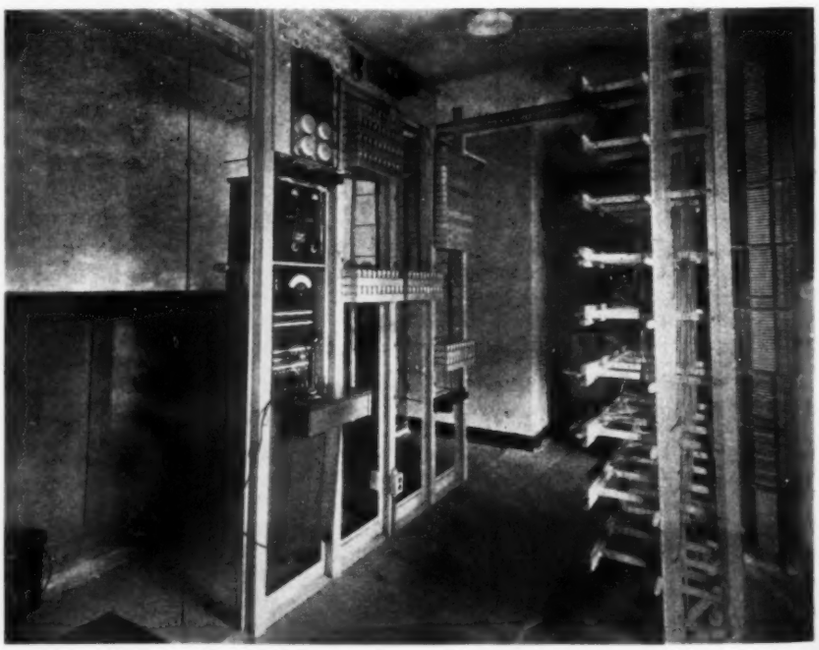
No sooner had the fire broken out when the Telephone Corporation's service men were busy erecting emergency equipment in another building and which was used until a new two-position Stromberg-Carlson Junior multiple switchboard was installed the latter part of 1930.

In the case of the Livonia fire, history again repeated itself. Fifty-two years ago, on January 29, 1878, fire swept through almost an entire block of frame buildings on the Main street, leveling all to the ground. On November 28, 1879, a second fire destroyed the few remaining buildings in this block. Eventually all of these buildings were replaced by substantial brick structures and again these buildings were laid low by the recent fire in March.

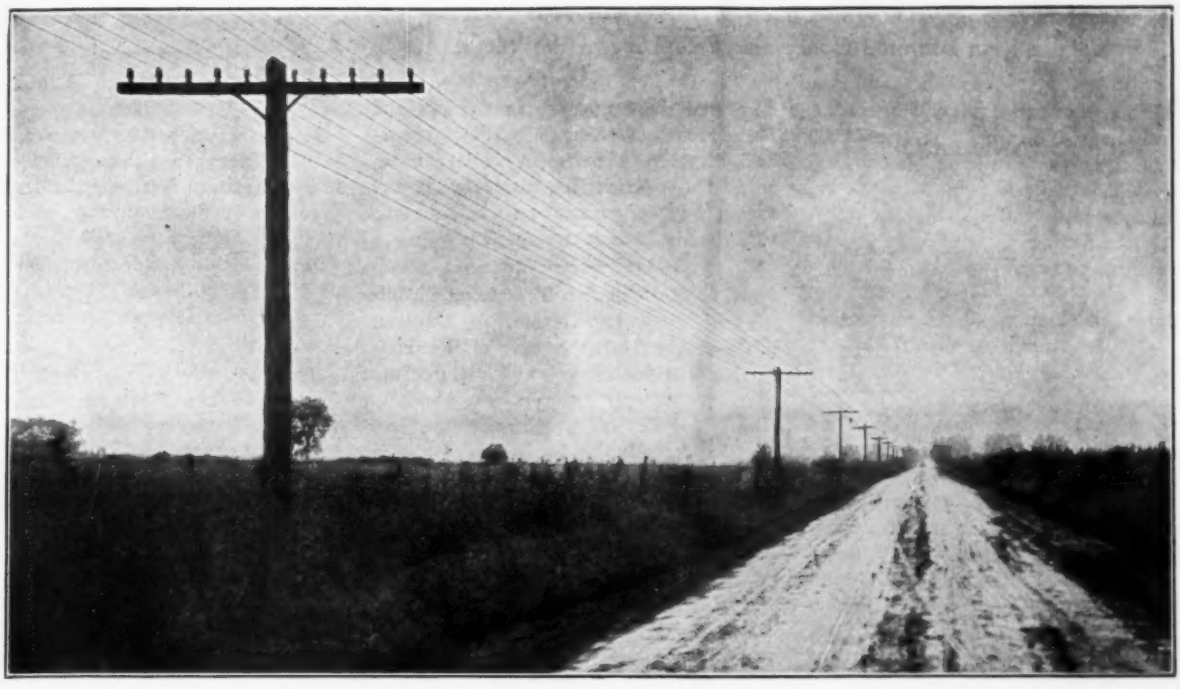
About 8:15 p. m. on March 19, the screaming of the town's siren broke through the quietness of the spring evening, calling Livonia's people from church services, theater and homes to suppress a threatened conflagration. Fire had started in the three-story building housing a department store and the telephone office. It was apparent to those first on the scene that the building could not be saved, so efforts were concentrated on preventing spread of the flames to adjoining property, but with little success. Two operators and the chief operator were on duty and true to operating tradition remained at their posts in spite of danger, and were warned from the building but little before their escape would have been impossible. Fred Sisson, wire chief, entered the burning building and attempted to save the office records, but was turned back by a sheet of flame. He then established connection with Geneseo, N. Y., from a pole, asking that the Rochester offices of the Rochester Telephone Corporation be notified and explained the danger to the Geneseo fire chief, who called Hemlock, Lakeville, Geneseo, Avon and Lima, with requests to send their fire apparatus. Aid from these villages was prompt and the combined efforts of all succeeded in confining the fire to the one block.

Long before the fire was under control, active preparations had been taken to restore telephone service. Anticipating a possible event of similar character, the engineering department of the Rochester Telephone Corporation had arranged that a three-position magneto switchboard removed from Pittsford, N. Y., be held available for emergency use. Stock lists were hastily prepared and at midnight the switchboard, together with other central office material and a crew of installers were on the road. By two the next day the new central office installation had been started in excellent quarters secured on the second floor of the village bank building. Specifications and sets of all required drawings had been completed at about the same time. All possible men were working in the space available. In the early morning hours new aerial cable and outside construction supplies arrived, a new 303 pair cable run to the new office, spliced in and terminated in remarkable time. As all office records had been destroyed, each subscriber was called to check his line and party number. Within twenty-four hours after service was interrupted, a considerable number of lines were again working, and in less than thirty hours complete service for all of the 608 stations had been re-established. In order that service might be restored at the earliest possible moment, installers worked continuously for long periods without rest. Two installers responded to calls at 9:30 p. m. and were on duty

(*Continued on page* 53.)



View showing Stromberg-Carlson equipment in Rochester, N. Y., Telephone Corporation exchange at Livonia, N. Y.



Northern White Cedar Poles in lines of the Illinois Consolidated Telephone Co., near Taylorville, Ill.

"Stronger than Wind and Sleet"

Northern White Cedar Poles placed over thirty years ago are still in the line—doing service. They have withstood the ravages of time and storm and deterioration. They have held up heavy, sleet coated wires; they have stood fast when high winds shrieked through their cross arms; they have held without flinching.

Northern White Cedar Poles are strong and light and durable. They have the proper taper and are stoutest where the strain is greatest—just above the groundline. They are light and easy to handle. They are durable—Cedar has a natural resistance to decay and will last indefinitely.

Northern White Cedar Ass'n

Minneapolis Minnesota

Northern White Cedar Poles

Telephone Activities Abroad

Dispatches from Foreign Countries Keep United States Telephone Men Informed Concerning Telephony of the World.

Dial Telephones Popular in Hawaii

More than 72 per cent of the 23,000 telephones in the Hawaiian Island are dial telephones. On January 1, 1930, the Hawaiian system ranked seventh in respect to the number of telephones in proportion to population.

Philippine Telephone Communication Extended Further

The Philippine Long Distance Telephone Co. recently announced the construction of an extensive long distance telephone system covering the entire rice-producing district of Central Luzon. This construction carries out a policy of development adopted by the board of directors of the Philippine Long Distance Telephone Co. when it took over the Manila and suburban system of the Philippine Telephone & Telegraph Co. and other telephone companies in the Visayan Islands.

Telephone Development in Europe

The steadily increasing telephone traffic between Great Britain and Germany has led to the installation recently of two new circuits to Berlin and Cologne. Twenty-three lines are now crossing the channel from the trunk exchange to Germany. Nine of these terminate in Berlin, seven in Hamburg, two each in Cologne, Dusseldorf, and Frankfort, and one in Bremen.

Rural Telephone Extension in South Africa

The mileage of farm telephone wires in South Africa has increased from 4,000 in 1924 to 27,000 at the present time, according to a statement by the South African minister of posts and telegraphs. The construction of new lines is proceeding at the rate of about 4,000 miles annually.

Venezuelan Government Requests Reduced Rates

The Ministerio de Fomento, according to notices published recently, has requested the Compania Anonima Nacional "Telefones de Venezuela" to reduce its rates. Office telephone rates in Caracas are now equivalent to $6 a month.

The dispatch cited the fact that the Venezuelan government had permitted the company to import, free of duty, all articles needed in the construction and maintenance of its lines and stations, and also recalled that on June 6, 1930, a contract had been signed with the company permitting it to establish telephone lines and systems or to acquire those in existence, and the companies in Caracas and Maracaibo had been accordingly purchased. The department believed, according to the report, that the favors shown by the government could be returned only in a rate reduction.

New Anglo--Spanish Telephone Circuit

The Postmaster General of England has announced that a new circuit connecting London directly with Barcelona has been brought into service. The new circuit, which will supplement the two circuits already in operation between London and Madrid, has been provided to meet the continued growth of traffic between England and Spain.

Telephone Traffic Increases in Irish Free State

The number of local calls in Ireland during 1930 totaled 19,750,000 and trunk calls numbered 1,960,000, an increase of 560,000 during the year, according to the annual report. The number of subscribers in Dublin reached 20,000 during the year, with 29,000 instruments in use.

Automatic Telephones to Be Installed in Norway

Two thousand connections are involved in the installation of automatic telephones in Kristiansand S, on the south coast of Norway. The contract for the installation has been let to the A/S Elektrisk Byraa, Oslo, which is associated with the Swedish Ericson interests, and which has previously installed automatic telephones in Arendal, Larvik and Haugesund, as well as in Reykjavik and Hafnafjord in Iceland. The installation is to be ready for use by 1932.

Telephone Line Opened Between Melbourne and Perth

The new telephone line between Melbourne, Victoria, and Perth, Western Australia, has been officially opened. The opening of this link in the land line communication system will ultimately connect Geraldton in Western Australia, with Cloncurry in Northern Queensland, a distance of more than 5,000 miles.

Italy Adopts New Rate Policy

A new policy of charging telephone rates according to what the traffic will bear has been inaugurated by ministerial decree in Italy. It is apparently the object of the government to encourage the use of telephones among small shopkeepers, farmers and artisans, since such persons were mentioned exclusively in connection with a lowered rate schedule, as those who should benefit by the lowered rates. Land owners, proprietors of shops dealing in luxuries, members of the professions, and artists must continue to pay higher rates.

Long Distance Service Established in China

Long distance service has recently been installed between Tsinan and Tsaochow, in southwestern Shantung, under the supervision of the Shantung provincial reconstruction department. The rate for five minutes' talk is fixed at 20 cents for 33 miles. With the operation of this service a long-felt need of the merchants is realized.

Radiotelephone Between Europe and Canary Islands

Radiotelephone service between Europe and the Canary Islands was officially inaugurated recently with appropriate ceremonies by the Spanish Telephone Co., an associate company of the International Telephone & Telegraph Corporation. Communication was established by means of the short wave radio stations of the Spanish Telephone Co. at Madrid and on the island of Tenerife, which latter is connected with Gran Canaria by means of aerial lines and a submarine cable of 73½ kilometers.

Automatic Telephones in China

Formal inauguration of the new automatic telephone service at Shenyang (Mukden), China, took place recently, according to the Chinese Economic Bulletin.

Bid on Long-Distance Telephones for Yugoslavia

Three companies are reported to have submitted a joint offer to the government of Yugoslavia for the construction of a long-distance telephone network in that country at a cost of $12,000,000 together with telephone exchanges. The work would occupy a seven-year period and a credit of twelve years. The companies are Siemens & Halske, Felten & Guilleaume, and the Standard Elektrizitats Gesellschaft. The latter was formed jointly by the International Telephone & Telegraph Corporation and the Berlin A. E. G.

IOWA TELEPHONE COMPANY ASKS FRANCHISE

An ordinance granting the Farmers' Mutual Telephone association the right to construct, maintain, and operate a telephone exchange and system in Newton, Ia., for a period of twenty-five years, has been submitted to the Newton city council.

The question will be submitted to the voters of the town at the city election, March 30, 1931.

With Manufacturers and Jobbers

KESTER SOLDER COMPANY ELECTION

At a meeting of the board of directors of the Kester Solder Co., Chicago, on February 17, Mr. F. C. Engelhart was elected president of the company.

Mr. Engelhart has been the directing head of the company for twenty years,

Mr. F. C. Engelhart, new president of the Kester Solder Company

acting in the position of general manager and treasurer. Under his guidance the company has grown from a small organization to the present large and complete plant at 4201 Wrightwood, Chicago, and with also a plant in Newark, N. J.

It is further announced that Mr. J. A. Reitzel, formerly sales promotion manager, has been elected to the position of general sales manager. Mr. Reitzel has had a broad experience in sales and advertising, having occupied executive positions with the Portland Cement Association and other well known organizations.

The Kester Solder Company is the largest manufacturer of Flux-Core solder in the world. Its products include Kester metal mender, acid-core solder, radio solder, rosin-core solder, paste-core solder, body solder and bar solder. Kester solder is noted for its unusually high quality—only virgin tin and lead are used and it exceeds the class A purity specifications of the A. S. T. M.

NEW TYPE OF POWER UNIT FOR MAGNETO BOARDS

Operators of magneto exchanges are showing considerable interest in a new type of power unit, recently developed by Fansteel Products Co., Inc., North Chicago, Ill.

This compact unit, known as Fansteel Type CAB-4, is a self-contained power supply, furnishing humless direct current for the operator's transmitter circuit and night alarm. The unit consists of a 4-volt storage battery, kept automatically at full charge by means of a standard Fansteel rectifier. The entire unit is housed in a ventilated steel cabinet measuring only 9½ inches wide by 8½ inches deep by 8½ inches high. Later models will be available also in 6- and 8-volt sizes.

The new Fansteel unit permanently replaces the dry cell or wet primary transmitter battery, the advantage being that it will last many years before needing repairs or replacements, constantly delivering full voltage during its entire life, resulting in clearer transmission and better service, with less attention and maintenance.

The unit operates from an ordinary light socket, consuming only 10 watts when operating at full capacity. And the storage battery provides a reserve of power great enough to operate an exchange for days in case of power line failure.

Simplicity and ruggedness are achieved in the design of the unit. It should prove convenient in service, too. Openings in the cabinet permit inspection of the float balls indicating the state of charge in the battery, also the electrolyte levels in the battery and rectifier cell. One simple adjustment regulates the charging rate, and under normal operation addi-

New type of power unit recently placed on market by the Fansteel Products Company

tion of water is necessary only three to four times a year.

The battery is the standard two-cell PBX size Exide ironclad type BI-5, of 14 ampere-hour capacity. The charging rectifier is the Fansteel tantalum electrolytic type, well known in telephone service. The tantalum electrodes, being practically immune to corrosion, it will operate for years without replacement. The electrolyte never needs changing. A rheostat regulates the charging rate to any point between a minimum of 50 and a maximum of 250 milliamperes. A few days of operation will determine the exact adjustment required to meet operating conditions, after which the charging rate need never be changed.

This new combination unit is useful also for inter-communicating telephones, local telegraph circuits, annunciator or calling systems, laboratory purposes—in fact, wherever a low-voltage direct current is required. Produced to sell at a moderate price, its use is very economical in comparison with other forms of D. C. power.

PULVERIZED IRON IN CONCRETE CONSTRUCTION

A new form of iron which telephone executives should find advantageous to include in the specifications for the construction of a telephone exchange, is pulverized iron. Iron bars frequently have been used for reinforcing concrete but the use of pulverized iron in structural work is something new.

The important characteristic of finely pulverized iron is that it is a standard waterproofing agent for outside or inside of either old or new walls of concrete, brick, or masonry. Thus, used in the walls and floors of a telephone exchange, particularly in the basement where the exchange equipment usually is placed, this form of waterproofing will eliminate the danger of seeping water which causes short circuits and general disintegration of equipment.

This pulverized iron is mixed with water and put on with a brush. Concrete and brick, being porous, soak up water very readily and when the water penetrates the wall it carries these fine iron particles with it.

When these particles rust, which they do very readily due to the chemicals previously added to hasten the process, they swell up to about four times their original size and seal up the pores completely. When unusually severe conditions are met, a plaster coat is added containing iron as well as the usual sand and cement.

Old walls may be successfully patched by this process as the iron creates a perfect bond between the old and the new. No better proof of how the iron adheres can be had than by cementing two pieces of brick together with it. If properly done, they cannot possibly be pulled apart.

The wearing qualities of a concrete floor are increased from two to five times by troweling in on top of the last coat, pulverized iron of slightly larger

particles than what is used in waterproofing. A floor thus treated is also practically waterproof, oilproof and dustproof.

Pulverized iron is manufactured by the National Waterproofing company, 1421 West Adams street, Chicago.

AUTOMATIC ELECTRIC INC. OFFERS NEW LINE OF SMALL RECTIFIERS

Designed especially for noiseless telephone operation, small thermionic tube rectifiers of Strowger manufacture are now available. These rectifiers are produced in the following capacities: .75, 1.5, 3 and 5 amperes. They are of the full-wave A. C. type, and can operate on current supplies ranging from 105 to 230

View of one of the several different capacities of small rectifiers of Strowger manufacture now available

volts, and from 25 to 60 cycles. In ordering, it is important to specify both voltage and cycles of the power supply from which the rectifier is to draw operating current.

All of these rectifiers are particularly designed and adapted to telephone use of any kind, due to their noiseless operation and utilization of the full-wave principle. For use in charging the 48-volt storage batteries used in Strowger dial exchanges, as well as the 24-volt storage batteries generally utilized in manual telephone exchanges they will prove ideal. They will also be found applicable to various miscellaneous uses where compact construction and trouble-free operation are desired. Bulletin 321, describing these small units in detail, has been prepared by the manufacturer, Automatic Electric Inc., Chicago, Ill., and will gladly be sent upon request.

STROMBERG-CARLSON ANNOUNCES NEW POLICE RADIO RECEIVER

A new and improved type of police radio receiver, designed for installation on police patrol automobiles, has been announced by the Stromberg-Carlson Telephone Manufacturing Co., of Rochester, N. Y. Stromberg-Carlson engineers have been experimenting on this type of radio for some time and have designed and built a receiver to rigid specifications, to stand the severe service imposed in police work. The complete receiver consists of receiver unit, loud speaker, control box and two antenna plates.

This receiver is of the same quality construction which is characteristic of all Stromberg-Carlson products, consisting of radio and telephone apparatus and aircraft radio receivers.

This company recently received a contract from the city of Rochester, N. Y., for thirty police receivers to be installed on patrol cars, and transmitting apparatus, which will be installed in the near future.

The radio system adds another link in the Rochester police department's chain of equipment and facilities in its fight against crime. This department is noted for its up-to-date methods in the detection of criminals; especially are its bureau of identification and ballistic bureau widely known. In establishing these bureaus the city and police officials have taken advantage of the research and development carried on by Rochester manufacturers. The Eastman Kodak Co. and the Bausch & Lomb Optical Co. have worked in conjunction with the police department in developing these two departments.

When the city of Rochester asked for bids for a police radio system Stromberg-Carlson engineers immediately began designing a receiver which would be on a par with the quality equipment in the other police bureaus. Police Chief Andrew Kavanaugh states that the Stromberg-Carlson receiver meets every qualification and is the best that he has seen in the country. He declares that when the equipment is completely installed, Rochester will have one of the best police radio systems in operation today.

The police radio system represents an important use of radio broadcasting for the public welfare. Cities which use such systems are better policed, as all the patrol cars can be kept in constant operation and not stand idle at precinct stations awaiting calls. The cars thus in operation are constantly under control of the dispatcher at the transmitter, so they are available every instant to be put into action.

NEW DRAWING BOARD TOP ELIMINATES INKING OF DRAWINGS

The "No-Ink" drawing board top is an especially fine white composition which gives a permanently white, smooth drawing surface. It is tough, resilient, stain-proof, scratch-proof, mar-proof and washable with soap and water.

Its use is simple. No manila paper is necessary. The regular drawing paper is attached directly to this surface and a 3-H or hard lead pencil is used. All lines are drawn with a double stroke and with a slight pressure on the pencil. The pressure of the first stroke ridges the paper, and the back stroke fills that valley evenly with lead. The result is a solid, opaque, evenly edged line, reproductions of which (blueprints, van dykes, etc.) are as clear cut and readable as an inked line. Changes can be made in any line by the usual rubbing-out process, and the ridges or valleys will not show on reproductions. Because of the resiliency of the board, the indentations in the surface made by the pressure of drawing tools disappear immediately. Due to the use of hard lead, which lies in a valley, the lines do not smudge when worked over for any length of time, and hence these drawings, even when filed away, can be taken out at any time and readable prints made from them.

The new "No-Ink" drawing surface has been on test for thirty months and has been approved by two of the largest drafting organizations in the country. Their engineers estimate a money saving of 35 per cent, besides quicker output of drawings and additional savings in working space and personnel overhead

Its use requires no costly change in equipment. The "No-Ink" drawing board top comes in any size sheets, is one-eighth inch thick, and the top edges are slightly rounded. They can be glued or fastened to old boards. The board life with ordinary use is estimated at eight to ten years. The prices are very reasonable, in fact the amount saved in manila paper alone will pay for this covering.

Patents have been applied for.

The "No-Ink" drawing board is obtainable through the W. H. Long Co., 420 North Clark street, Chicago.

CAMPBELL JOINS SALES STAFF OF AMERICAN ELECTRIC

John A. Campbell, until recently switchboard engineer for the Leich Electric company, Genoa, Ill., has joined the

John A. Campbell

sales organization of the American Electric Company, Inc., Chicago, Ill.

Mr. Campbell first entered the telephone field in 1903 when he became a lineman for the Winona Telephone company, Winamac, Ind. Since that time he has been active in the industry, serving in various capacities in both the operating and manufacturing fields.

After eleven years with the Winona company, during which he became assistant manager of the Plymouth exchange, he joined the Kellogg Switchboard & Supply company in 1914 as Indiana representative. Later he transferred to the Leich Electric company as Ohio representative, which position he held until 1928 when he went to the home office as switchboard engineer.

RESTORES SERVICE IN RECORD TIME

(*Continued from page* 48.)

almost continuously for twenty-seven hours.

The people of Livonia have complimented the Rochester Telephone Corporation upon the excellent way the entire emergency job was handled. The village was without toll service for only a short time. A temporary instrument, upon a pole, was almost immediately available, and soon after toll stations were established in the new quarters. In rendering this unselfish service, the telephone force has earned the unqualified approbation of the community. It may well be said that the Rochester Corporations' employes in this emergency upheld the finest traditions of the spirit of service.

Immediately following the fire the Rochester Telephone Company laid plans to erect a building in a residential district which would be free from the fire hazard. Plans were drawn up for such a building and today the telephone equipment is housed in a building which is of English style, non-commercial in appearance, one story and a half high and which fits nicely into the residential surroundings. The building is of semi-fireproof construction; walls are of cinder block with a finish of stucco, and with asbestos shingles on the roof.

Complete new equipment for Livonia was contracted for with the Stromberg-Carlson Telephone Manufacturing Company. That company's Junior multiple switchboard was chosen. It consists of two positions with jacks arranged upon a three-panel multiple basis. By this arrangement when a line lamp signal appears below several line jacks for each call, all operators are able to see each incoming signal and any unoccupied operator can immediately answer the call and complete it without the aid of another operator and without reaching more than one panel outside of her own position. The board has 160 central energy line equipments, with an ultimate capacity of 300 lines; 20 toll lines, with an ultimate of 30 lines; 80 magneto lines and 10 outgoing local trunk circuits.

TELO-MIKE—WHAT IT IS AND WHAT IT DOES

(*Continued from page* 46.)

phone equipment. Type A and B is a combination type which fits on all Western Electric and Bell equipment whether regular desk and wall telephones or he Bell dial system; type C fits the Kellogg equipment; type D fits the Stromberg-Carlson equipment, and E-F the Automatic Electric and American Electric equipment. Types are also manufactured to fit equipment made by the Chicago Telephone Supply Co. and the Leich Electric Co. "Telo-Mike" may be ordered in several colors. At present the most popular colors are black and white.

"Telo-Mike" is meeting with exceptional favor with telephone users in the wholesale, retail and manufacturing trades; in busy general and private offices; druggists and grocers, who find it necessary to take orders over the telephone in the midst of the chatter of customers and clerks; doctors who wish to discuss patients' ailments in privacy; executives whose time is valuable and who dislike to waste time by misunderstandings and repetitions over the telephone; shop superintendents who realize the importance of receiving and transmitting orders by telephone with accuracy--a mistake may cost thousands of dollars; and in the home, where lively children often interfere with the pleasure of telephone conversation and the business of telephone ordering.

The Ohio Bell Telephone Co. will spend approximately $37,000 to place telephone lines underground in Sandusky, Ohio, according to an announcement by M. J. McCabe, district commercial manager. This will make possible the elimination of 28 telephone poles. Plans call for a four-duct conduit which will contain two cables at the start.

THEY ARE THEIR OWN BEST SALESMEN

IT doesn't take a salesman to sell Victor Cells to the telephone industry.

A single case of Victors tested by actual service on the line brings more standing reorders than any salesman could write.

It's in the product and not in promotion that our skill and effort goes. The result of this concentration of attention is manifest in Victor's superior service, greater uniformity and longer life.

And there, after all, is where the telephone industry's interest is.

Put a case of Victors on trial and let line service be the judge.

VICTOR TELEPHONE CELLS

"THE CELL THAT SELLS ITSELF"

Victor Telephone Cells are manufactured by the BOND ELECTRIC CORPORATION, CARBON PRODUCTS DIVISION PLANT, LANCASTER, OHIO; Executive Offices, Jersey City, N. J.; Branch Offices, Chicago, Ill. and San Francisco, Calif.

UNIQUE FURNACE

GASOLINE—KEROSENE

PATENTED ARRANGEMENT FOR DISLODGING COIL WITHOUT TEARING DOWN FURNACE
PATENTED SEAMLESS TUBING COIL GENERATOR
IMPROVED ONE PIECE BURNER
HAND HOLD FOR CLEANER ONE TURN CLEANS ORIFICE
AUTOMATIC ORIFICE CLEANER
18 GUAGE STEEL TANK WELDED BOTTOM
AUTOMATIC PUMP INSIDE TANK

10 MINUTES TO MELT 50 lbs. OF SOLDER

But—more important—

The experienced cable splicer will be surprised at the length of time it will remain in the field without attention!

Literature?

UNIQUE MANUFACTURING CO., Inc
221 Whiting St. Chicago, Ill.

POINTERS ON PROPER SUB-STATION INSTALLATION

(*Continued from page 21.*)

Protectors Not Required

If the lines feeding a certain group of telephones are not in any way exposed to high potential hazards, then substation protection is not necessary. For example, an apartment house may be fed by a cable placed entirely underground from it to the central office which would not be exposed in any way so protectors would not be required on any telephones in the building. In some exchanges cables are all underground with terminals placed on poles so that drops can be run aerially into buildings. Such areas would be considered unexposed and substation protection not required if there is no chance that the twisted pair drops would come in contact with light wires. The short twisted pair drops would not be considered a lighting hazard.

COMPANY PURCHASES NEW TYPE LAMP LINE BOARD

The Blandinsville Switchboard Company of Blandinsville, Ill., has just ordered a two-position Stromberg-Carlson lamp line magneto switchboard, the new board which has caused so much favorable comment in the telephone trade. It will be equipped with 220 short lines and 40 long lines and will be complete with battery and charging equipment.

This board has been one of the features at recent state telephone conventions and chief operators, plant superintendents and traffic officials have highly praised the board.

The outstanding feature of this equipment is that lamps are used both as line signals and as supervisory or ring-off signals instead of the usual drops, or any variation thereof.

Other features are as follows:

1. More positive line signal.
2. More positive cord-circuit, clear-out, or supervisory signal.
3. More positive code-ringing indication to the operator, due to intermittent flashing of lamp signal in sympathy with operation of sub-station generator.
4. Common battery type of operator's circuit, with constant high transmission efficiency.
5. Lamp signals demand more prompt attention both in original and in supervisory answering time, thus resulting in a better grade of service.
6. In the face of the switchboard there are two jacks to which an artificial network, representing 20 db, is terminated. The operator can connect up any line through the cord circuits and cut this network in and out while making transmission tests to determine whether the transmission is up to standard.
7. Two jacks per position are used for the cord tone test circuit. The network of this test circuit consists of the proper resistance coils, induction coils and tone buzzer in order that a tone can be placed through the cord and plug under test. In making the test, the operator must shake or pull the cord up and down in order to determine the break or circuit interruption.

STROMBERG-CARLSON DECLARES EXTRA DIVIDEND

Directors of the Stromberg-Carlson Telephone Manufacturing Company of Rochester, New York, paid a regular quarterly dividend of $1.625 on the preferred stock and the regular of $.25 and an extra of $1.25 on the common, March 2.

In 1927 and 1928 four regular dividends and one extra were issued. During 1929, four regulars and two extras were issued and in 1930 four regulars and three extras were paid.

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DIRECTORY ADVERTISING EXCLUSIVELY

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Specialization on Public Utility Accounting Records and Audits enables us to best serve Telephone Companies.
HERDRICH AND BOGGS
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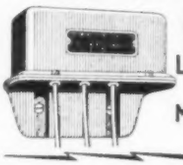
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